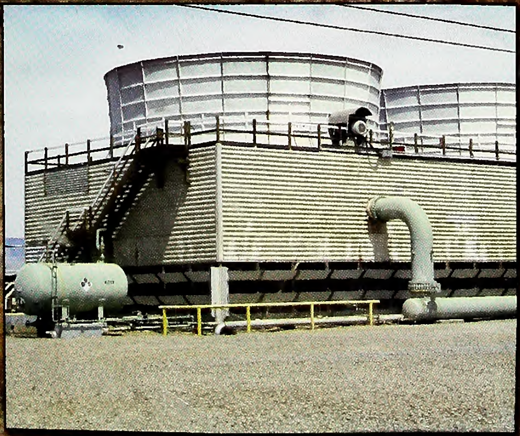
Solar Energy Project

Final Environmental Impact Statement

Volume I: Dear Reader Letter, Title Page, Abstract, Contents, Executive Summary, and Chapters 1–5.



BLM

National System of Public Lands
U.S. Department of the Interior
Bureau of Land Management

October 2011

FES 11-26

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Phoenix District Office
21605 North 7th Avenue
Phoenix, Arizona 85027-2929

TAKE PRIDE IN AMERICA

In Reply Refer To:
2800 (P0200)
AZ-040-09-5101-ER-A240
AZA-34187

Dear Reader:

Enclosed is the Final Environmental Impact Statement (EIS) entitled: *Final Environmental Impact Statement (EIS) for the Proposed Sonoran Solar Energy Project, Maricopa County, Arizona.* This document has been developed in accordance with the National Environmental Policy Act of 1969 and the Mineral Leasing Act of 1920, as amended. The Bureau of Land Management (BLM) prepared this document in consultation with several cooperating agencies, including the Arizona Game and Fish Department; the Arizona Department of Water Resources; the City of Goodyear, Arizona; and the Town of Buckeye, Arizona. This document takes into account public comments received during the scoping effort as well as comments received on the Draft EIS, which was published in April 2010. The Final EIS is open for a 30-day review period beginning the date the U.S. Environmental Protection Agency publishes the Notice of Availability of the Final EIS in the Federal Register.

The Final EIS has been prepared to analyze the potential impacts of granting a right-of way to Boulevard Associates, LLC for the purpose of constructing and operating a proposed 375-megawatt (MW) concentrated solar thermal (CST) power plant and ancillary facilities on 3,620 acres of BLM-administered land in Maricopa County, Arizona. The proposed CST project would be sited in the Little Rainbow Valley, east of State Route 85, and south of the Buckeye Hills and the town of Buckeye in Maricopa County, Arizona. This is in BLM's Lower Gila South Planning Area which is managed under the Lower Gila South Resource Management Plan (1988), as amended (2005).

The Final EIS analyzed four action alternatives: 1) the Proposed Action (as described above); 2) Alternative A: Reduced Water Use (using a dry-cooling technology); 3) Sub-alternative A1: Photovoltaic (a 300 MW photovoltaic facility occupying 2,013 acres); and 4) Alternative B: Reduced Footprint (a 250 MW wet-cooled facility occupying 2,320 acres). Alternatives A and B were developed in response to issues raised during the scoping process. Sub-alternative A1 was developed in response to agency and public comments on the Draft EIS as an alternative to Alternative A for reducing water consumption. Sub-alternative Al would use photovoltaic (PV) technology instead of solar thermal technology to reduce water use, to decrease the project footprint, and to avoid other sensitive resources raised as issues by the public and agency cooperators. The use of PV technology was originally eliminated from further analysis in the Draft EIS due to technological and economic infeasibility. However, changing technology and market conditions have allowed a reconsideration of PV technology in the Final EIS. A Brine Concentrator Option is also analyzed as a component of the Proposed Action and Alternative B. As required under the National Environmental Policy Act (NEPA), the EIS also analyzed a No Action

alternative which would preclude development of the Sonoran Solar Energy Project (SSEP) in any configuration and maintain existing land uses in the project area.

The BLM has identified Sub-alternative A1 (which would use photovoltaic technology to reduce water use) as the agency-preferred alternative. This sub-alternative would reasonably accomplish the purpose and need for the Federal action while fulfilling the BLM's statutory mission and responsibilities, giving consideration to economic, environmental, and technical factors.

The EIS is not a decision document. Rather, it is a document that will inform the BLM's final decision on whether to issue a right-of-way grant. It will also inform other regulatory agencies for which permits will be required. The Final EIS is being released to inform the public and interested parties of potential impacts associated with implementing the proponent's proposal, as well as alternatives identified by the agencies. A Record of Decision will be released following a 30-day comment period on the Final EIS. The Record of Decision will detail the BLM's final decision as well as any required mitigation for the project.

Comments will be accepted for 30 days following the U.S. Environmental Protection Agency's (EPA) publication of the Notice of Availability in the Federal Register. All timely written comments, postmarked by November 21, 2011, on the Final EIS will be considered in the preparation of the Record of Decision, currently scheduled for release in late November 2011. Comments may be submitted electronically to the attention of Joe Incardine, National Project Manager at jincardi@blm.gov. Please include "SSEP DEIS in the subject line of your e-mail message. Comments may also be submitted by mail to: Sonoran Solar Energy Project, Joe Incardine, National Project Manager, BLM Phoenix District Office /Lower Sonoran Field Office, 21605 North 7th Avenue, Phoenix, Arizona 85027-2929.

Before including your address, phone number, e-mail address, or other personal identifying information with your comments, be advised that your entire comments, including your personal identifying information, may be made publicly available at any time. Although you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organization or businesses, will be available for public inspection in their entirety.

Printed copies of the Final EIS are available for review at the Lower Sonoran Field Office and the Arizona State Office. The document may also be viewed at the following public libraries in Maricopa County, Arizona.

- Buckeye Public Library, 310 N. 6th Street, Buckeye, Arizona 85236
- Gila Bend Public Library, 202N. Euclid Avenue, Gila Bend, Arizona 85337
- Goodyear Public Library, 250 N. Litchfield Road, Goodyear, Arizona 85338

You may also access the document on the Internet at:
http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar.html

Sincerely,

Angelita S. Bulletts
District Manager

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SONORAN SOLAR ENERGY PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

Bureau of Land Management
Phoenix District Office

Prepared by:
Bureau of Land Management
Lower Sonoran Field Office

October 2011

Angelita S. Bulletts
District Manager

Sonoran Solar Energy Project
Maricopa County, Arizona
Final Environmental Impact Statement

Lead Agency: U. S. Department of the Interior, Bureau of Land Management

Type of Action:	Draft	( )	Final	(X)
	Administrative	( )	Legislative	( )

Jurisdiction: Phoenix District Office, Lower Sonoran Field Office, Arizona

Abstract: This final environmental impact statement (EIS) analyzes the environmental effects of constructing and operating a 375-megawatt (MW) concentrated solar thermal electrical generating facility on approximately 3,620 acres of BLM-administered public lands in Maricopa County, Arizona. The final EIS was prepared by the BLM in response to Boulevard Associates, LLC's right-of-way grant application to the BLM.

The Proposed Action would include two independent, concentrated solar electric generating facilities with expected outputs of 125 MW and 250 MW. Both facilities would use parabolic trough solar thermal technology to produce electrical power using steam turbine generators fed from solar steam generators. The generators would connect to a new 500-kilovolt (kV) on-site switchyard. Electricity from the switchyard would be transmitted through a generation-tie line to connect to the existing Jojoba Switchyard. The proposed facility would use a wet-cooled tower for power plant cooling and up to 3,003 acre-feet of water per year supplied from an on-site well field. Three natural gas co-fired boilers would be constructed to supplement solar heating when less than optimal solar conditions exist (i.e., nighttime and cloud cover) and would be used for up to 25% of annual electrical production. A thermal energy storage system may also be installed to supplement electrical output during reduced solar activity or to extend electrical output into the evening hours.

The proposed Sonoran Solar Energy Project would include a number of ancillary facilities and infrastructure, including power blocks and solar trough arrays, evaporation ponds, access roads, administration buildings, a land treatment unit, drainage collection and discharge facilities, and open areas on approximately 3,620 acres.

The final EIS also analyzes a No Action alternative (as required by the National Environmental Policy Act) that would not authorize construction and operation of the facility, two action alternatives to the Proposed Action, and one sub-alternative. Action alternatives consist of the following:

- Alternative A: Reduced Water Use would use dry-cooling technology
- Sub-alternative A1: Photovoltaic would use photovoltaic technology instead of solar thermal technology to reduce water use and would occupy approximately 2,013 acres
- Alternative B: Reduced Footprint would be a 250-MW wet-cooled facility on 2,394 acres.

These alternatives were developed in response to issues and concerns raised during scoping and in comments on the draft EIS. BLM's preferred alternative is Sub-alternative A1: Photovoltaic.

Two options are analyzed in the final EIS. A Brine Concentrator Option is analyzed to consider further reduction in water use under the Proposed Action and Alternative B. A Generation Tie (gen-tie) Line Option is analyzed to consider an alternate gen-tie line route under all action alternatives.

Notices of availability (NOA) of the draft EIS were published in the *Federal Register* by the Environmental Protection Agency (EPA) on April 9, 2010, and by the BLM on April 19, 2010. Publication of the EPA NOA initiated a 45-day, formal public and agency comment period, during which the BLM solicited comments regarding the project, the alternatives analyzed, and potential environmental impacts. Three open houses were held in Phoenix, Buckeye, and Gila Bend, Arizona, on April 27, 28, and 29, 2010, respectively. The purpose of these meetings was to provide information on the project and to collect public comment on the adequacy and accuracy of the analysis in the draft EIS. Comments were accepted until 5:00 PM on Thursday, May 24, 2010, for use in development of the final EIS. Comments were submitted to Joe Incardine, National Project Manager, BLM Phoenix District Office, Lower Sonoran Field Office, 21605 North 7th Avenue, Phoenix, Arizona, 85027-2929, or sent to sonoransolar@blm.gov.

Appendix G of this final EIS provides the comments received on the draft EIS, BLM's prepared responses to those comments, revisions that were made in response to the comments, changes that were made to the action alternatives between the preparation of the draft EIS and the preparation of the final EIS, and the addition of Sub-alternative A1 and the Generation Tie Line Option. Vertical lines in the left margin of a page indicate where text in the draft EIS has been deleted, revised, or supplemented for this final EIS, except for Appendix G, H, and I, which are entirely new documents. With the same exceptions, new text that was not in the draft EIS is underlined in the final EIS.

For information about the project or to view the final EIS, visit
http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar.html

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Executive Summary

Executive Summary

ES.1 Introduction

The Department of the Interior (DOI) Bureau of Land Management (BLM) Lower Sonoran Field Office (LSFO) has received a proposal from Boulevard Associates, LLC (Boulevard) to construct and operate the Sonoran Solar Energy Project (SSEP), a concentrated solar thermal (CST) power plant with ancillary linear facilities. The SSEP would be located in Little Rainbow Valley, east of State Route (SR) 85 and south of the Buckeye Hills in Maricopa County, Arizona. The SSEP would be located in portions of Sections 19 and 27–34 of Township 2 South, Range 2 West; portions of Sections 12–16, 19–26, and 36 of Township 2 South, Range 3 West; and portions of Sections 23–26 of Township 2 South, Range 4 West (Map 1).

The project footprint of the Proposed Action is approximately 3,620 acres, and would accommodate power blocks, solar fields, evaporation ponds, heat transfer fluid (HTF) land treatment areas, and required linear facilities (access roads, generation tie [gen-tie] line, gas lines, and well field and water pipelines). Land ownership is almost exclusively BLM, with approximately 1.5 miles of road improvements proposed on private and state lands at the western edge of the Project Area, as well as approximately 0.5 mile of gen-tie line on private land.

This project area is managed under the *Lower Gila South Resource Management Plan* (BLM 1988), as amended (BLM 2005a, BLM 2009a). A BLM team completed a land-use plan (LUP) conformance analysis on November 21, 2008, and determined that the Proposed Action would not conflict with other decisions throughout the plan. In addition to the Proposed Action, two action alternatives and one sub-alternative are also considered, as well as two options that could be applied to multiple alternatives. Sub-alterative A1 (which would use photovoltaic [PV] technology to reduce water consumption) and a Generation Tie (Gen-tie) Line Option were not considered in the draft environmental impact statement (EIS), but are considered in this final EIS. A supplemental EIS was not prepared because no supplemental documentation is needed for the BLM to make a reasoned decision between alternatives to the proposed federal action. Sub-alternative A1 would result in impacts either *within* the range of or *less than* those that would result from the alternatives considered in the draft EIS. Furthermore, Sub-alternative A1 was developed in direct response to public and agency comment on the draft EIS, and made possible by advancements in PV technology. Similarly, the Gen-tie Line Option would result in impacts of the same nature, to the same resources, and of the same approximate extent (within 1%) as those considered in the draft EIS, and would not result in any unique site-specific impacts not considered in the draft EIS. As part of its responsibilities under the National Environmental Policy Act of 1969 (NEPA), the BLM must consider a reasonable range of alternatives. The BLM has identified Sub-alternative A1 as the agency-preferred alternative. This sub-alternative would reasonably accomplish the purpose and need for the federal action while fulfilling the BLM's statutory mission and responsibilities, giving consideration to economic, environmental, and technical factors. In particular, this sub-alternative best addresses public and agency concerns regarding groundwater use while meeting the purpose and need.

As the administrator of federal lands within the Project Area, the BLM is the lead federal agency responsible for preparation of this EIS. The DOI/BLM Arizona State Office and the LSFO have determined that the proposed project constitutes a major federal action that requires the preparation of an EIS in accordance with NEPA, as amended. This final EIS was prepared in accordance with NEPA, and is intended to provide the public and decision makers with an opportunity to review and comment on a complete and objective evaluation of impacts that would occur from the Proposed Action and reasonable alternatives.

ES.2 Purpose and Need

The BLM's purpose and need for this action is to respond to Boulevard's application under Title V of Federal Land Policy and Management Act of 1976 (FLPMA) (43 United States Code [U.S.C.] § 1761) for a right-of-way (ROW) grant to construct, operate, maintain, and decommission a solar power plant[1] and ancillary facilities in compliance with FLPMA, BLM ROW regulations, and other applicable federal laws. The BLM will decide whether to approve, approve with modification, or deny issuance of a ROW grant to Boulevard for the proposed solar energy project.

ES.2.1 Purpose of the Action

Specifically, the BLM's purposes in considering the SSEP are as follows:

- To meet public needs for use authorizations such as ROWs, permits, leases, and easements, while avoiding or minimizing adverse impacts to other resource values and locating the uses in conformance with LUPs. Section 211 of the Energy Policy Act of 2005 (119 Stat. 594, 660) and the BLM's Solar Energy Development Policy establish a framework to process applications for ROWs and direct the BLM to be responsive to solar energy project applicants while protecting the environment.
- To implement the FLPMA and the *Lower Gila South Resource Management Plan* (BLM 1988), as amended (BLM 2005a) by providing consistent land-management decisions based on the standards set forth by both authorities. Both authorities recognize that the Project Area is available for multiple uses.
- To process ROW application AZA-34187 submitted by Boulevard in an expeditious manner consistent with both Executive Order (EO) 13212 (Actions to Expedite Energy-Related Projects) and mandates of the Energy Policy Act of 2005 and the American Recovery and Reinvestment Act of 2009.

ES.2.2 Need for the Action

The BLM's needs in considering the Proposed Action are as follows:

- Grant ROWs for "systems for generation, transmission, and distribution of electric energy" and/or "other necessary… systems or facilities which are in the public interest," under Title V of FLPMA (43 U.S.C. §§ 1761–1771)
- Support the President's New Energy for America Plan (2008), which seeks to ensure that 10% of United States electricity is generated from renewable sources by 2012 and to 25% by 2025.
- Further the purpose of Secretarial Order 3285A1 (March 11, 2009), which "establishes the development of environmentally responsible renewable energy as a priority for the Department of the Interior" (BLM Instruction Memorandum [IM] No. 2011-059).

[1] The purpose and need was changed under the BLM's authority as the lead federal agency for this action to be more inclusive of other solar power options considered in the final EIS.

ES.3 Public Involvement

ES.3.1 Public Scoping

The BLM has taken a variety of steps to inform the public, special interest groups, and local, state, and federal agencies about the Proposed Action and alternatives for the SSEP, and to solicit feedback from these interested parties to help shape the project's scope and alternatives.

The BLM conducted internal agency and public scoping to solicit input and identify the environmental and social concerns and issues associated with the SSEP. A notice of intent (NOI) was published in the *Federal Register* on July 8, 2009. Publication of the NOI initiated a 60-day formal public and agency scoping period, during which the BLM solicited comments regarding the SSEP and its potential impacts. The BLM prepared scoping information materials and provided copies to federal, state, and local agencies; Native American tribes; and members of the general public. Information regarding upcoming meetings and opportunities for comment was published in various local news media. The BLM conducted open house meetings to disseminate information, answer questions, and solicit comments on August 4, 2009, in Phoenix, Arizona; on August 5, 2009, in Buckeye, Arizona; and on August 6, 2009, in Gila Bend, Arizona. The BLM also provided opportunities for comments to be submitted through the United States mail and via email.

ES.3.2 Identified Issues

As noted above, issues to be addressed in the EIS were identified internally, and by the public and the agencies during the scoping process. The 24 issues identified during scoping are summarized below.

Issue 1: Process

Which tribes will be consulted as part of the required government-to-government consultation? How would construction and operation of the SSEP affect the interests and concerns of Native American people? Have the U.S. Fish and Wildlife Service (USFWS) and the Arizona Game and Fish Department (AZGFD) been consulted regarding how construction and operation of the SSEP would affect wildlife, including threatened, endangered, and sensitive species, and their habitat? Has the U.S. Army Corps of Engineers (USACE) been consulted regarding how construction and operation of the SSEP would affect waters of the United States? How would other federal, state, and local agencies; interest groups; and individuals be involved as stakeholders? What additional permits would be needed for facility construction and operation?

Issue 2: Purpose and Need

What effect would construction and operation of the SSEP have on continued use of fossil fuels for electrical generation? What energy market would this facility serve?

Issue 3: Alternatives

What is the desired energy profile (capacity factor and time of energy output) for the SSEP, and is it supported by the purpose and need of the SSEP? What other Project Area configurations or technologies would meet the SSEP purpose and reduce impacts to resources? Are there other locations for the SSEP that would reduce potential use conflicts and meet the SSEP purpose, even if they are not located on public land? Would residential and wholesale-distributed generation, in conjunction with energy efficiency practices, be a viable alternative to the proposed SSEP?

Issue 4: Air Quality

What effect would construction and operation of the facility have on local air quality? What is the SSEP's projected use of natural gas? Within the constraints of the desired energy profile (capacity factor and time of energy output), what opportunities exist to reduce impacts to air quality through operational changes such as the inclusion of a thermal storage unit? What effect would inclusion of a thermal storage unit have on reducing emissions from natural gas–fired electrical generation? What effect would expansion of the solar field to replace the thermal input provided by gas have on reducing emissions or on other resources? What opportunities exist to reduce impacts to air quality through mitigation plans (e.g., fugitive dust control and equipment emissions mitigation plans)?

Issue 5: Climate Change

What is the full carbon footprint of the proposed SSEP, and what phases of the SSEP are appropriate to include in that analysis? Against what other energy-generation types should the SSEP's greenhouse gas (GHG) footprint be measured to determine the net GHG reductions or gains? Could the SSEP be designed in a way to reduce the impact to carbon sequestration? How should potential change in climate be measured and quantified in the EIS? How might anticipated change in climate affect the Project Area's resources and sensitive areas? How would this affect the operation of the proposed SSEP? How might climate change affect cumulative impacts?

Issue 6: Cultural Resources

How would construction and operation of the SSEP affect cultural resources, including the physical integrity of sacred sites?

Issue 7: Geology and Minerals

What effect would construction and operation of the SSEP have on landforms and subsurface geology in the Project Area? How would construction and operation of the SSEP impact mineral resources and their availability for use?

Issue 8: Hazardous Materials and Hazardous and Solid Waste

How would waste generated during construction and operation of the facility be managed (i.e., storage and disposal)?

Issue 9: Land Use and Access

What effect would construction and operation of a solar facility have on existing land uses in and adjacent to the Project Area, including master-planned communities, the Hidden Valley transportation system, a sand and gravel operation, and military air space? What effect would construction and operation of a solar facility have on proposed land uses in and adjacent to the Project Area, including the land-use objectives of federal, state, tribal, and local plans and policies?

Issue 10: Livestock Grazing

What effect would construction and operation of the SSEP have on grazing allotments in the area (i.e., the Beloat and Arnold grazing allotments)?

Issue 11: Mitigation

What opportunities exist for on-site mitigation of impacts to other resources and values? What opportunities exist to ensure adequate funds would be available for complete restoration of the SSEP site after it is retired or abandoned?

Issue 12: Noise

What effect would construction and operation of the SSEP have on the soundscape in nearby residential communities? What effect would construction and operation of that facility have on the experience of visitors to the adjacent wilderness?

Issue 13: Paleontology

Would construction of the SSEP result in the discovery or destruction of fossils in the area?

Issue 14: Recreation and Wilderness Characteristics

What effect would construction and operation of the SSEP have on the suitability and availability of surrounding public lands and access roads for recreation purposes? There is an area adjacent to the SSEP to the south that may have wilderness characteristics. How would the construction and operation of that facility impact the potential wilderness characteristics of this area?

Issue 15: Socioeconomics

What employment opportunities would be provided by construction and operation of the SSEP? What contribution would construction and operation of that facility have on local revenue and the economy? What effect would the facility have on minority and low-income populations? What effect would the facility have on local services such as emergency medical treatment and police response?

Issue 16: Soils

What effect would the construction and operation of the SSEP have on soils in the Project Area, including cryptobiotic crust, cyanobacteria, mosses, and lichens? What measures can be taken to reduce impacts to drainage, erosion, and sediment control?

Issue 17: Special Designations

What effect would construction and operation of the SSEP have on the resource values and experiences of visitors to the adjacent national monument and wilderness?

Issue 18: Threatened, Endangered, and Special-status Species (plants and animals)

What effect would the construction and operation the SSEP (including the ancillary facilities) have on local populations of Endangered Species Act (ESA)–listed or candidate species or other special-status species and suitable habitats? This would include impacts to suitable upland, riparian, wetland, or aquatic (Gila River) habitat and impacts to species that are listed or candidates for listing under the ESA, or are otherwise designated as a sensitive species, including Tucson shovelnosed snake (*Chionactis occipitalis klauberi*), Sonoran desert tortoise (*Gopherus morafkai*), yellow-billed cuckoo (*Coccycus americanus*), Yuma clapper rail (*Rallus longirostris yumanensis*), southwestern willow flycatcher (*Empidonax traillii extimus*), California barrel cactus (*Ferocactus cylindraceus*), least bittern (*Ixobrychus exilis*), and western burrowing owl (*Athene cunicularia hypugea*)? What measures could be taken to reduce the adverse impacts?

Issue 19: Transportation and Traffic

What effect would construction and operation of the SSEP have on the operation of planned or existing transportation or utility systems and facilities? What effect would construction and operation of necessary utilities for the SSEP have on existing and proposed transportation systems? What effect would the SSEP have on access to local private and public lands?

Issue 20: Vegetation

What effect would the construction and operation of the SSEP and associated facilities have on native plants (including loss of native vegetation from direct disturbance [e.g., grading the proposed Project Area] and increased shade from the installation of equipment as well as the introduction and spread of invasive species into the Project Area)? Could plant loss be mitigated by salvage and reuse or replanting of native plants in the Project Area?

Issue 21: Visual Resources

What effect would construction of the SSEP have on the scenic quality and character of the existing landscape? How would the character of the viewshed from key observation points (KOP) in the Sonoran Desert National Monument and the North Maricopa Mountains and Sierra Estrella Wilderness be modified by the construction and operation of a solar power–generating facility? What would be the cumulative effect to visual resources (the scenery) visible from KOPs along Arizona highways from the construction and operation of a solar-powered electricity-generating facility if all the approximately 35 ROWs for similar facilities were approved? What measures could be taken to reduce the impacts?

Issue 22: Water Resources

How would the withdrawal of groundwater from the Project Area impact the quantity and quality of water in the aquifer under the City of Goodyear, including the flow of lower-quality water into the aquifer from the waterlogged area near the Gila River? How would it affect the quantity of water available for use by the Buckeye Hills Regional Park, or the quantity and quality of water in existing private wells in the area; the water table in Rainbow Valley? How would it affect aquatic habitats, springs, soils, and land surface (e.g., subsidence)?

What measures could be taken to prevent further degradation of impaired waters? How would the permitting process for the SSEP impact existing water rights? What methods could be used to reduce the amount of groundwater needed for the SSEP, and what would be the impact on the quantity and quality of surface water and groundwater resources if these methods were implemented? How would construction and operation of the SSEP impact the quality of existing surface water or groundwater? How would construction and operation of that facility impact existing Project Area drainage patterns, including floodplains and washes? What would be the cumulative impact on the local hydrographic basin from the development and use of local water sources to meet SSEP water demands? How would the concentrated dewatered waste from evaporation ponds, total dissolved solids (TDS), nitrates, boron, and salt be disposed of? What effect would groundwater pumping to supply water for the SSEP have on area aquifers? What effect would other solar-powered electricity-generation technologies have on use and conservation of water?

Issue 23: Wildlife

To what extent would modification of the landscape in the Project Area's boundary impact adjacent habitat? Would disruptions in surface flows in washes and uplands lead to broad-scale mortality of vegetation and impact wildlife distribution and abundance beyond the SSEP footprint?

What effects would the construction and operation of the SSEP and ancillary facilities have on local wildlife populations and individuals? Would effects include disruption of north-south movements of wildlife between the Maricopa Mountains and the Buckeye Hills; disruption of the regional landscape of wildlife linkages between the Gila Bend Mountains, the Sierra Estrella mountain range, and the Gila River; impacts to individual animals and populations as a result of increased shade introduced into the environment from the installation of equipment; impacts to wildlife species, particularly migratory waterfowl, as a result of exposure to contaminants in evaporation ponds or stormwater detention basins; impacts to wildlife species near the Gila River; and impacts to desert bighorn sheep (*Ovis canadensis nelson*) historical habitat and reintroduction plans?

Issue 24: Cumulative Impacts

What would be the cumulative effects of other solar-powered electricity-generating facilities being considered in western Arizona, California, and Nevada on the Sonoran Desert landscape? What past, present, and reasonably foreseeable projects and their connected actions (i.e., transmission needs and associated projects) would be appropriate to include in a cumulative impacts analysis? What resources are appropriate to include in a cumulative impacts analysis? What are appropriate impact indicators and information to include in that analysis? How might climate change affect the cumulative impacts of these facilities on the Sonoran Desert?

ES.3.3 Public Comments and Meetings on the Draft EIS

As part of NEPA requirements, notices of availability (NOA) of the draft EIS were published in the *Federal Register* by the EPA on April 9, 2010, and by the BLM on April 19, 2010. Publication of the EPA NOA initiated a 45-day, formal public and agency comment period, during which the BLM solicited comments regarding the project, the alternatives analyzed, and potential environmental impacts. Copies were mailed to individuals and made available in public libraries in Buckeye, Gila Bend, and Goodyear, Arizona, and on the BLM's website.

In addition, the BLM held agency and public meetings to discuss the draft EIS in Phoenix, Arizona, on April 27, 2010, and public meetings in Gila Bend and Buckeye, Arizona, on April 28 and 29, 2010, respectively. Meeting attendees were encouraged to provide written comments on the issues and alternatives analyzed in the draft EIS. The BLM received a total of 161 comment letters on the draft EIS. In preparing the final EIS, the BLM considered all comments. Appendix A (Response to Comments) contains each unique comment received and BLM's associated response. The appendix also contains a description of the comment analysis and response process.

ES.4 Alternatives

Four alternatives and one sub-alternative are considered in detail in this final EIS: the No Action alternative, the Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), Sub-alternative A1: Photovoltaic, and Alternative B: Reduced Footprint. An optional component, a brine concentrator, is considered as an additional element that could be added to the action alternatives that would use a wet-cooling system (the Proposed Action and Alternative B). In addition, an alternative gen-tie line alignment is being considered as part of the action alternatives as an optional means of routing produced electricity from the SSEP solar field to the Jojoba Switchyard. These alternatives are briefly described below and described more fully in Chapter 2.

ES.4.1 No Action Alternative

Under the No Action alternative, Boulevard's ROW application would not be authorized and the SSEP would not be developed. Existing land uses in the area would continue, including livestock grazing and limited dispersed recreation.

ES.4.2 Proposed Action

Under the Proposed Action, the SSEP would consist of three major types of facilities: a well field, external linear facilities, and power plants (the main project footprint). Each of these components is explained in detail in Chapter 2 (Section 2.5).

The power plant facilities would be located on approximately 3,313 graded acres in the primary project footprint. The power plant facility footprint would be fenced and would function largely as a single facility. Specific components of the power plant facilities would include power block areas, administration buildings and local warehouses, solar collector field arrangements, evaporation ponds, a land-treatment unit, on-site transmission facilities, on-site gas pipeline facilities, drainage collection and discharge facilities, groundwater wells used for water supply, and access roads.

The linear facilities would include access roads, a gen-tie line to carry electricity to the Jojoba switchyard, a natural gas pipeline, and water pipelines.

As many as four high-capacity groundwater production wells would be needed to meet the water supply requirements of the SSEP at full build-out, with an estimated total water demand of 2,305–3,003 acre-feet per year (afy) for the 375-megawatt (MW) project in an average year. A well field would be developed to supply water for the SSEP during the construction and operation phases. The well field would be located approximately 1.2 miles east of the power plant area, and would include four wells with on-site pumping facilities, a booster pump station, supporting linear facilities (including service roads, buried pipelines, and electrical service), and a number of linear facilities to be developed externally from the main power plant footprint.

Under the Proposed Action, the cooling system for heat rejection from the steam cycle would consist of a surface condenser, circulating water system, and a wet-cooling tower. Water for cooling tower make-up, process water make-up, and other industrial uses (such as mirror washing) would be supplied from the groundwater wells described above, which would also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). A package water treatment system would be used to treat the water to meet potable standards. A sanitary septic system and on-site leach field would be used to dispose of sanitary wastewater. A full description of the Proposed Action is found in Chapter 2 (Section 2.5).

ES.4.3 Alternative A: Reduced Water Use (dry-cooled CST)

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be constructed with dry-cooling technology rather than the wet cooling considered under the Proposed Action. Alternative A would require approximately 116–151 afy for the 375-MW project, which is approximately 95% less water than would be used under the Proposed Action. Two groundwater wells would be located in the same area as under the Proposed Action. Under Alternative A, dry cooling would produce approximately 9% less energy than the Proposed Action from the same size solar field.

In general, most aspects of Alternative A would be the same as under the Proposed Action. Major elements that differ from the Proposed Action include smaller evaporation ponds and an air-cooled condenser (ACC) for power plant cooling. Under Alternative A, the evaporation ponds would be

approximately 2 acres for the 125-MW unit and 4 acres for 250-MW unit, instead of 10 acres and 20 acres, respectively, under the Proposed Action. One ACC would be installed in each power block, and would include two "wet surface air coolers" that would be used for auxiliary cooling. A full description of Alternative A is found in Chapter 2 (Section 2.6).

ES.4.4 Sub-alternative A1: Photovoltaic

Sub-alternative A1 was developed to respond to public and agency comments on water consumption. It was developed after the draft EIS due to advancements in technology and a change in market conditions that allowed for a reconsideration of PV technology as a viable alternative (see Section 1.2). Under Sub-alternative A1, the SSEP would be constructed as a 300-MW PV power plant and would generate electricity using multiple arrays of PV panels electrically connected to associated power inverter units.

Although annual (solar) generating capacity would be reduced by approximately 95,000 MWh under this sub-alternative, it would result in a reduced project footprint and decreased water consumption relative to the Proposed Action. It would also reduce or avoid impacts to other resources raised as issues by the public and agency cooperators, including wildlife habitat and travel corridors, washes, and nearby residences.

The primary project footprint under Sub-alternative A1 would occupy approximately 1,907 acres, or approximately 58% of the footprint under the Proposed Action (Map 2). Sub-alternative A1 would require approximately 33 afy of water for operations (and an annual average of 65 afy with construction use factored in), which would be supplied by up to two groundwater wells in the same area as under the other action alternatives. This sub-alternative would consume approximately 98% less water than the estimated water requirements of the Proposed Action. Total solar energy generation would be approximately 11% less than the anticipated generation under the Proposed Action.

ES.4.5 Alternative B: Reduced (Project) Footprint

Alternative B was developed to respond to issues identified during agency and public scoping, including potential impacts to wildlife linkages and travel corridors, residential areas, xeroriparian vegetation and washes, water use, and the overall level of surface disturbance resulting from the SSEP. Alternative B would address these issues with a project footprint that is approximately 35% smaller than under the Proposed Action. Under Alternative B, the SSEP would consist of two concentrated solar electricity-generating facilities, each with an expected net output of 125 MW (for a total of 250 MW), rather than 375 MW as under the Proposed Action. This design would allow for a reduced project footprint and avoidance of wildlife habitat features, including xeroriparian habitat (an unnamed tributary to Waterman Wash) and a water source (stock pond) located in the eastern portion of the Project Area under the Proposed Action.

The main project footprint under Alternative B (not including linear features such as roads, pipelines, or transmission lines) would occupy approximately 2,136 acres, or approximately 63% of the main project footprint under the Proposed Action. Alternative B would require approximately 1,518–2,003 afy of water for the 250-MW project, which is approximately 34% less water used and 33% less solar generation than under the Proposed Action. Water would be supplied by three groundwater wells located in the same area as under the Proposed Action. The same cooling method would be used as under the Proposed Action. A full description of Alternative B is found in Chapter 2 (Section 2.8).

ES.4.6 Reduced Water Use Option: Brine Concentrator

The water treatment design under the Proposed Action and Alternative B (both wet cooled) includes pre-treatment and post-treatment systems that would consist of multimedia filters and a two-pass reverse-osmosis system. A brine concentrator is an optional piece of equipment that can be added to the post-

treatment system under either of these alternatives. The use of a brine concentrator would reduce the volume of wastewater exiting the facility. It would also allow a reduction in evaporation pond sizes and a 7% reduction in plant water consumption. The additional heat requirement for this piece of equipment would result in a slight decrease in electrical output. A full description of the Reduced Water Use Option is found in Chapter 2 (Section 2.9).

ES.4.7 Generation Tie Line Option

As part of the Arizona Corporation Commission Certificate of Environmental Compatibility (CEC) process (see Section 1.6.3 for a description), Boulevard has developed an alternate gen-tie line alignment, which could be applied to any of the action alternatives. Because this optional route would meet the purpose and need for the project and could feasibly be implemented, BLM is considering it in this final EIS as an alternative (or optional) means of routing produced electricity from the SSEP solar field to the Jojoba Switchyard. This option would address alternate methods and locations for crossing existing high-voltage transmission lines near the project, as well as an alternate route through existing designated utility corridors that may be subject to future development.

The Gen-tie Line Option would be routed in a generally southwestern direction and would use an existing utility corridor, as described in Section 2.5.2.5.3. It would be initially routed directly south along a new road and would then make a 90 degree turn to the west, also along a new road. It would then extend westward to the Jojoba Switchyard, as shown on Map 3. There would be approximately 10 pulling sites required to install the conductors along the Gen-tie Line Option alignment. Maps 2, 4, 5, and 6 show the location of the Gen-tie Line Option in relation to alternative site layouts.

ES.5 Environmental Setting

As previously noted, the SSEP would be located in the west end of the Little Rainbow Valley, south of the Buckeye Hills in Maricopa County, Arizona. The closest communities to the SSEP are the Town of Gila Bend, the City of Goodyear, and the Town of Buckeye.

The Project Area is located in the Basin and Range Physiographic Province, which is distinguished by isolated, roughly parallel mountain ranges separated by closed desert basins. Mountain ranges trend north-south with distinctive alluvial areas known as bajadas. A subdivision of the Basin and Range Province, the Sonoran Desert, encompasses the entire Project Area and adjacent lands. The Sonoran Desert is characterized by mountains with intervening plains. The Project Area and surrounding vegetation are located entirely in the Lower Colorado Valley Subdivision of the Sonoran Desertscrub Biome (Brown 1994).

Little Rainbow Valley is a small valley that lies between the Buckeye Hills to the north and the Maricopa Mountains to the south, and connects the much larger Rainbow Valley to the east with the Gila Bend area to the west. The Project Area landscape is characterized by flat-to-low desert hills and plains with low vegetative diversity typical of creosote flats. The Project Area is almost entirely undeveloped, though a few areas have isolated developments. Primary land uses in and around the Project Area include agriculture, cattle grazing, mining, utilities, dispersed residences, dispersed recreation activities, and transportation. West of the Project Area, land uses include a regional landfill and state prison complex. Approximately 50 residences are located east of the Project Area in addition to two dairies surrounded by areas of agricultural lands. Off-highway vehicle (OHV) use occurs throughout the area on existing, primitive roads and utility corridors.

A detailed description of the potentially affected existing environment (i.e., the physical, biological, social, and economic values and resources) of the Project Area is described in detail in Chapter 3. A total

of 18 resources identified through public and agency scoping and collaboration with the Interdisciplinary Team (ID Team) is brought forward for analysis and described in Chapter 4.

ES.6 Environmental Impacts

Table 2.16 in Chapter 2 summarizes the potential impacts to each element of the environment under each alternative. Detailed descriptions of the impacts under each alternative are provided in Chapter 4, along with a discussion of potential mitigation measures, residual impacts, short-term uses versus long-term productivity, and irretrievable and irreversible commitments of resources that would result from implementation of the alternatives. Cumulative impacts to resource values and uses of the Project Area that would result from implementation of the alternatives are also disclosed in Chapter 4. A summary describing the general conclusions of the effects analysis is presented below.

ES.6.1 Air Quality

The SSEP would be located in Maricopa County, most of which is a serious nonattainment area for particulate matter (PM) with aerodynamic diameter equal to or less than 10 micrometers (PM_{10}) and a nonattainment area for 8-hour ozone. Project-specific and cumulative air quality impacts would occur under all action alternatives. Construction and operational emissions could contribute to the exceedances of the National Ambient Air Quality Standards (NAAQS) for PM with an aerodynamic diameter equal or less than 2.5 micrometers ($PM_{2.5}$) and PM_{10}; however, emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS. Under the action alternatives, minor impacts to visibility would also result from plume visibility by casual observers in nearby recreation areas, except for Sub-alternative A1, which would have no point sources of emissions and therefore no visible plume of water vapor. Boulevard has committed to meeting the de minimis level of construction emissions to ensure conformance to the State Implementation Plan (SIP).

ES.6.2 Climate Change

Implementation of the action alternatives would result in reduced carbon dioxide (CO_2) sequestration (biosequestration) through removal of vegetation and increased GHG emissions from construction and operation of the SSEP. However, the SSEP would have a net lifetime GHG emissions level of less than zero. Under Sub-alternative A1, total construction and operations GHG emissions generated over the life of the project would be less than 1% of the total GHG emissions that would result from the Proposed Action. Implementation of any action alternative would reduce GHG emissions levels over the life of the project by displacing nonrenewable grid electricity with renewable electricity.

ES.6.3 Cultural Resources

Nine archaeological sites were identified in the 8,646-acre cultural resources analysis area (Swanson 2009). BLM consulted with the Arizona State Historic Preservation Office (SHPO) as part of its compliance with Section 106 of the National Historic Preservation Act (NHPA; 16 U.S.C. § 470F) to determine the National Register of Historic Places (NRHP) eligibility of these nine sites. According to the NRHP, historic properties can be archaeological sites, objects, districts, buildings, or structures eligible for the NRHP. SHPO concurred with the BLM's determination that three sites in the area of potential effects (APE) are eligible for the NRHP under Criterion D of 36 CFR § 60.4 (see Section 5.4 for detail on SHPO and tribal consultation processes). These three sites—AZ T:10:238 (Arizona State Museum [ASM]), T:14:165 (ASM), and T:14:167 (ASM)—are prehistoric artifact scatters associated with the Hohokam Tradition. SHPO has recommended a memorandum of agreement (MOA) and data recovery plan to resolve the direct adverse effect on one unavoidable site, with monitoring of the other two sites to ensure that they are avoided during construction and operations. A copy of the draft MOA was sent to

SHPO for review on July 28, 2011, and to the tribes on July 12, 2011. SHPO provided comments on a draft version of the MOA on August 22, 2011. BLM is working with SHPO and other consulting parties to finalize the MOA and a historic properties treatment plan, which will address procedures for scientific data recovery, monitoring, and unanticipated discoveries in the event the project is approved.

ES.6.4 Geology and Minerals

Two geological units have been identified in the Project Area. Terrain modification (e.g., cuts, fills, drainage diversion channels, and protective berms) from construction activities (e.g., excavation and grading) would result under all action alternatives. Additionally, mineable bedrock deposits used for crushed rock are present in the Project Area. Construction and operation of the SSEP under the action alternatives would preclude these deposits from being used within the project footprint for the 30-plus year life.

ES.6.5 Hazardous Materials and Hazardous and Solid Waste

Under all action alternatives except for Sub-alternative A1, construction and operation of the SSEP would involve the use and generation of hazardous materials and hazardous and solid waste (e.g., HTF, petroleum products, etc.). Under Sub-alternative A1, the generation of other hazardous and nonhazardous solid waste streams would be the same as the Proposed Action, except there would be no activated and spent carbon hydrogen volumes required and no waste mirror glass generated. Additionally, no HTF, natural gas pipeline, sodium hydroxide, hypochlorite, or sulfuric acid would be required under Sub-alternative A1. Thus, there is potential for direct impacts (such as contamination of soils) from hazardous materials and hazardous and solid waste spills and leaks during construction and operation of the SSEP under the action alternatives. However, these potential impacts would be mitigated by adherence to existing laws, ordinances, regulations, and standards that govern the use, handling, and disposal of these materials.

ES.6.6 Land Use and Access

Under the action alternatives, existing land uses would be precluded and replaced with renewable energy production within the SSEP facility footprint. Impacts to land use and access include loss of existing land uses (grazing and recreation) and temporary interruption of access by increased traffic on SR-85 and Komatke Road during construction of the SSEP. There would also be impacts to residential land use under all action alternatives due to increases in noise levels above ambient conditions of up to 20 A-weighted decibels (dBA) during construction at residential receptor ST-2, and up to 5 dBA at residential receptor LT-1. There is potential for conflict with an existing mining claim under the action alternatives. The Project Area would be closed to backcountry driving, resulting in a loss of opportunities for motorized recreation. Access to adjacent public lands would remain available via roads leading and adjacent to the Project Area.

ES.6.7 Livestock Grazing

Removal of vegetation and fencing of the proposed SSEP facility under each action alternative would prevent grazing and foraging by livestock and loss of animal unit months (AUM) on grazing allotments in the Project Area. Additionally, increased traffic associated with the construction and operation of the SSEP would increase the risk of injury or death to individual cattle through vehicle strikes.

ES.6.8 Noise

Construction activities (e.g., vehicle traffic, equipment operation, soil compaction, and venting during site commissioning) as well as operational activities (e.g., vehicle traffic, operation of power blocks, the

transmission line and switchyard) would increase ambient noise levels near the SSEP. Noise levels would increase during construction by approximately 5–20 dBA, depending on the distance between the Project Area and the noise receptor.

ES.6.9 Paleontology

No paleontological resources are known to exist in the Project Area, and the potential for fossils is low (Potential Fossil Yield Classification [PFYC] 2). There are no anticipated impacts to paleontological resources associated with construction of the SSEP under any action alternative.

ES.6.10 Recreation and Wilderness Characteristics

Implementation of any of the action alternatives would alter the recreational setting and opportunities of the Project Area due to vegetation removal, introduction of human-made facilities to the landscape, increases in ambient noise levels from construction, increased traffic, and competition from other nonrecreation activities. The primitive recreational experience and setting in the adjacent Sonoran Desert National Monument, North Maricopa Mountains Wilderness, Sierra Estrella Wilderness, and the Buckeye Hills Regional Park would be impacted due to alteration of portions of the viewshed by industrial activities and increases in ambient noise levels from construction. Motorized use of the main Project Area would end with construction and operation of the SSEP. The Project Area does not possess wilderness characteristics. BLM lands of sufficient size to meet the wilderness characteristics size criteria are not present due to roads that cross the BLM lands in and surrounding the Project Area.

ES.6.11 Socioeconomics

Implementation of the action alternatives would result in changes to area employment (an increase in the number of jobs and employment income) from construction and operation of the SSEP. There is potential for a short-term decrease in property values of up to 14.9% for homes within 0.15 mile of the SSEP. Under all action alternatives, there would be an increase in state and county taxes and revenues during construction and operations. In addition, BLM would receive annual rental and MW capacity fees under all action alternatives. No impacts were identified under any alternative that would disproportionately affect potential environmental justice (EJ) populations living within a 5-mile radius of the SSEP.

ES.6.12 Soils

Six soil complexes have been identified in the Project Area. Under all action alternatives, long-term disturbance to soils would occur from the clearing of vegetation, grading of the project footprint to 3% slope, compaction within the project footprint, and from the improvement and construction of roads in the Project Area. Short-term disturbance to soils would occur from the installation of the buried gas and water lines, and from temporary access roads. Impacts to soils include the loss of soil productivity from topsoil loss, soil erosion, and the loss of water infiltration due to soil compaction.

ES.6.13 Special Designations

There is potential for impacts to three special designation areas near the Project Area (though not directly within the project footprint) under any action alternative. Indirect negative impacts to special designation areas, including the North Maricopa and Sierra Estrella wilderness areas and the Sonoran Desert National Monument, would consist of degradation of primitive recreation settings due to alteration of the viewshed due to project construction and operation, and impacts to wildlife from activities associated with construction and operation of the SSEP.

ES.6.14 Transportation and Traffic

Each action alternative would result in traffic congestion and delays on SR-85 from an increase in traffic during SSEP construction and operation (a decreased level of service). Construction of the SSEP would preclude motorized travel on existing primitive roads in the Project Area, reducing opportunities for motorized recreation.

ES.6.15 Vegetation and Special-status Species

Implementation of any action alternative would result in the temporary and long-term removal of vegetation communities and special-status plant species from the Project Area. Indirect impacts would also occur to vegetation communities and special-status plant species from fugitive dust and increased risk of weed introduction associated with increased vehicle traffic on paved roads for the life of the project.

ES.6.16 Visual Resources

Implementation of any action alternative would result in direct impacts to the landscape (scenery) due to vegetation removal, leveling of the existing landform, and the construction of human-made facilities on the landscape. The visual contrasts from the SSEP would rank from weak to strong depending on the time of day and viewing location. The industrial character of these facilities would contrast with the natural landscape character of the existing landforms and vegetation. Glare and other visual effects from the solar panels would be visible for some distance adjacent to the Project Area.

ES.6.17 Water Resources

Construction and operation of the SSEP under any action alternative would disturb drainages and floodplains in the area. There would be direct and indirect changes to stormwater, flood, and surface water flows in and around the solar field. Additionally, use of on-site wells would lower existing groundwater levels and increase drawdown in area wells. This drawdown would be most dramatic under the Proposed Action. Alternative A and Alternative B would use approximately 95% and 33% less water, respectively, than the Proposed Action. Sub-alternative A1 would have the lowest amount of groundwater usage of all action alternatives (98% less than the Proposed Action), and would result in drawdown in regional wells of less than 1 foot.

ES.6.18 Wildlife and Special-status Species

Under any action alternative, impacts to wildlife from construction and operation of the SSEP would include wildlife displacement and habitat degradation due to human activities and weed invasion, loss of habitat connectivity from habitat fragmentation and road barrier effects, and increased risk of exposure to potentially toxic constituents in evaporation ponds. Loss of habitat (water) from removal of the Civilian Conservation Corps (CCC) stock pond would occur under all the action alternatives except for Sub-alternative A1.

ES.7 Potential Mitigation Measures

Under all action alternatives, applicant-committed environmental protection measures and best management practices (BMP) would be implemented to minimize adverse impacts to sensitive environmental resources (see Section 2.3.3, Table 2.2).

Under all action alternatives, Boulevard would comply with all applicable laws, ordinances, regulations, and standards (LORS), and would obtain and meet the requirements of all necessary permits. Resource-specific LORS are presented in Chapter 3 and, as applicable to the analysis, Chapter 4.

Potential mitigation measures are also proposed for individual resources in Chapter 4. Potential mitigation includes additional means, measures, or practices not incorporated into the Proposed Action or action alternatives that would further reduce or eliminate impacts. Residual impacts that would persist following implementation of potential mitigation measures are addressed immediately following each Potential Mitigation Measures section in Chapter 4. The selection of these proposed mitigation measures will be decided in the record of decision (ROD) for the final EIS.

ES.8 Agency Coordination/Consultation

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction of their designated critical habitat. It also requires consultation with the USFWS in making that determination. A biological assessment (BA) was prepared to determine if the development and/or operation of the SSEP would have any effects on species included in the list provided by the USFWS. The BA was submitted to the USFWS on December 8, 2009. The USFWS responded on January 11, 2010, issuing its concurrence that no adverse effects are likely to occur to the species listed, and indicating that no further consultation with the USFWS would be required at this time. In its concurrence letter, the USFWS recommends that a groundwater monitoring plan be established and implemented to track and confirm that the SSEP would have no unanticipated effects on the Gila River. Copies of the August 11, 2009 species list letter and the January 11, 2010 concurrence letter are included in Appendix B (Consultation Letters).

The USACE was contacted on September 4, 2009, for an approved Department of the Army jurisdictional determination (JD) for the Project Area. The USACE indicated that the Project Area does not contain any waters of the U. S., and thus no Section 404 permit would be required for the discharge of dredged or fill material associated with the SSEP.

In July 2009, the BLM invited 20 federal, state, and local entities to participate in the project as cooperating agencies. Formal cooperating agency status has been confirmed with the Town of Buckeye, the City of Goodyear, AZGFD, and the Arizona Department of Water Resources (ADWR).

The BLM is engaged in formal government-to-government consultation with several federally recognized tribes with interest in the SSEP. Consultation with tribes is required under Section 106 of the NHPA, NEPA, and other laws and EOs.

The BLM formally initiated Section 106 consultation with the Arizona SHPO on October 1, 2009. The Class III cultural resources survey report and BLM's recommendations of eligibility were forwarded to SHPO for further consultation. SHPO concurred with the BLM's determination that three archaeological sites are eligible for the NRHP. SHPO was updated on the addition of Sub-alternative A1 on April 11, 2011, and the BLM recommended a determination of adverse effect. SHPO responded reiterating the eligibility of the three sites, concurring with the adverse effect determination, and recommending an MOA and data recovery plan to resolve the direct adverse effect on the unavoidable site, with monitoring of the two sites to ensure that they are avoided during construction and operations. A copy of the draft MOA and data recovery plan was sent to SHPO for review on July 28, 2011. As required, a Notification of Adverse Effect Determination was sent to the Advisory Council on Historic Preservation on July 20, 2011, inviting the council to participate in development of the MOA. The council declined participation on August 5, 2011.

The BLM initiated formal consultation with tribes in consultation letters on July 7, 2009. These letters were sent to the following eight federally recognized tribes: Ak-Chin Indian Community, Fort McDowell Yavapai Nation, Gila River Indian Community, Hopi Tribe, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, Tohono O'odham Nation, and the Yavapai-Prescott Indian Tribe. The tribes were provided copies of the survey report and draft EIS for review and comment. The tribes were updated on the addition of Sub-alternative A1 to the final EIS on April 11, 2011, and consulted on determinations of eligibility and effect. A letter requesting tribal participation in the MOA was sent to the tribes with a copy of a preliminary draft MOA on July 12, 2011. Tribal consultations will continue through the development and implementation of the MOA and a historic properties treatment plan (which will include a data recovery plan). The MOA and treatment plan will be attachments to this project's ROD.

ES.9 Next Steps

Following EPA and BLM's publication of an NOA of the final EIS in the *Federal Register*, there will be a 30-day review and comment period. After the 30-day period, a ROD will be prepared and signed. Decisions made regarding the Proposed Action and alternatives will be documented in the ROD, which will be signed by the authorized officer, the BLM's Phoenix District Manager. The BLM decision will apply only to public lands.

In the ROD, the BLM Phoenix District Manager will determine the following:

- Whether the analysis contained in this EIS is adequate for the purposes of reaching an informed decision regarding the ROW application
- Whether to approve the Proposed Action, select a different alternative, select a combination of alternatives, or deny the ROW request
- Whether the Proposed Action and alternatives are in conformance with applicable land and resource management plans (RMP)
- Appropriate terms and conditions, if the ROW is approved

CHAPTER 1.
INTRODUCTION, PURPOSE AND NEED

1 INTRODUCTION, PURPOSE AND NEED

1.1 Introduction

The DOI's BLM administers approximately 262 million acres (106 million hectares) of public land in the United States. This administrative responsibility consists of stewardship, conservation, and resource use, including the development of energy resources, in an environmentally sound manner. Solar energy is one of many energy resources now being developed on BLM-administered lands under ROW authorizations or leases issued in accordance with the requirements of the FLPMA of 1976 (43 U.S.C. § 1701 et seq.).

Boulevard Associates, LLC (Boulevard) has applied to the BLM for a ROW on public lands to construct and operate the SSEP, a CST power plant and ancillary linear facilities. The original ROW application area was 14,759.39 acres; however, the footprint of the SSEP would occupy approximately 3,620 acres, consisting of power blocks, solar fields, evaporation ponds, HTF land treatment areas, and required linear facilities. These linear facilities would consist of access road (or roads), a gen-tie line, a well field and water pipelines, and a gas pipeline.

The SSEP would be located in the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills and the Town of Buckeye in Maricopa County, Arizona. The BLM must consider requests for ROWs on the land it administers for projects that are in the public interest, for example, the construction of power projects, their associated transmission lines, and other appurtenant facilities, as authorized by FLPMA Title V (43 U.S.C. §§ 1761–1771).

Solar energy has significant potential in the western United States. With a growing population, Arizona's demand for electricity is increasing and will continue to do so for the foreseeable future. Solar energy and other renewable energy sources can play leading roles in meeting these demands. New requirements for utility companies to provide renewable energy options are driving the promotion of solar energy development. The BLM is committed to promoting the Energy Policy Act of 2005 and providing for renewable energy projects on public lands where possible and where appropriate.

The BLM has prepared this EIS to respond to Boulevard's request in a manner that seeks to avoid or reduce impacts on resource values and uses associated with the project and to prevent unnecessary or undue degradation of the public lands.

1.2 Project Background

Boulevard submitted a Standard Form (SF) 299 *Application for Transportation and Utility Systems and Facilities on Federal Lands* to the BLM for the SSEP on June 28, 2007. In seeking a ROW grant from the BLM, Boulevard's intention is to develop a fully dispatchable (able to produce and deliver power to the electrical grid on demand or according to a schedule), utility-scale electricity-generating facility capable of providing commercial quantities of clean, renewable, solar electricity during peak hours of demand to the state of Arizona. The SSEP is designed to assist the state in meeting the objectives mandated by the Arizona Corporation Commission's Renewable Energy Standard and Tariff Rules (Arizona Administrative Code [A.A.C.] R14-2-1801–1815), and other renewable energy mandates, which call on the state's electric utilities to produce 15% of their electricity from renewable sources by 2025. The SSEP is also intended to reduce the electricity sector's GHG emissions, contribute to Arizona's future electric power needs, and promote fuel diversity to protect consumers and electric utilities from fuel unavailability and price fluctuations.

During initial development of the draft EIS, several common requirements and objectives for renewable energy emerged from BLM discussions with potential customers (for SSEP electricity) and researchers at the National Renewable Energy Laboratory (NREL), and from the proponent's engagement with potential customers. During discussions with the BLM in October 2009, potential customers and NREL expressed the following:

- It was important to develop a diversified and sustainable energy portfolio that includes solar energy. Customers desired consistent electrical generation to the grid and indicated they may charge penalties for too much variability in generation. Variability in electrical generation increases risk to customers and the ability to negotiate power purchase agreements.
- Customers were looking for opportunities for large-scale solar thermal generation and considered CST technology very dependable (dispatchable) and valid for commercial applications. Customers considered CST technology generally a lower risk, especially in combination with thermal storage and natural gas back-up. CST technology with thermal storage and up to 25% natural gas back-up provides continued electrical generation into the evening high-demand period when the sun begins to set.
- Customers did not consider large scale PV facilities practical for commercial operation. The power produced by a PV facility is not dispatchable. A passing cloud can reduce electrical output 10%–20% without immediate online natural gas back-up. Without a reliable system of natural gas back-up and storage capacity, PV systems have no inertia to extend power generation into evening high-demand hours. The largest PV facility some customers would consider is 18–25 MW.
- Some customers support renewable energy projects when sited on previously disturbed lands.

Based on this input, the SSEP draft EIS issued in April 2010 concluded that PV was not a viable alternative technology and dismissed it from further analysis in Section 2.9.3. However, since the draft EIS was issued, the following technological changes and market trends have allowed BLM and Boulevard to revisit the feasibility of PV as a viable alternative to the proposed CST project (see Section 2.7 [Sub-alternative A1: Photovoltaic]):

- PV technology continued to evolve and improve. PV panel efficiencies, resistance to degradation, and power inverter technology/performance have all improved over the past two years. The maturation of PV technology and the PV marketplace, coupled with the significant increase in manufacturing capacity, contributed to a substantial reduction in the installed cost of PV power generation on a dollar-per-kilowatt basis. The end result is that currently and in the near term, PV facilities are forecasted to be cheaper relative to comparably sized CST facilities at certain locations.
- The potential cost advantages of a PV project and the continuing advancements in PV technology have caused utility offtakers to seriously consider utility-scale PV as a viable alternative to CST. As the technology continues to improve and other PV projects reach commercial operation, the utility transmission study and planning departments have gained clarity on the likely system impacts from a large PV facility and have gained comfort in the suitability of interconnecting large PV projects. PV technology, both large and small scale, now presents electric utilities with a second viable option for solar power generation.
- The lower costs to develop a PV project, as evidenced by continuing market trends, make a PV project desirable for potential customers, especially given the sluggish economy and the customers' slowed population and load growth.

The SSEP would be located in an area that is well suited for solar generation due to its high availability of solar irradiance throughout the year (U.S. Department of Energy [DOE] 2009a), level topography, ease of access, and availability of transmission capacity from the nearby high-voltage transmission lines at the Jojoba Switchyard.

Boulevard's specific intentions are as follows:

- Develop a utility-scale solar power project using proven technology capable of generating up to 375 MW of electricity.
- Develop a solar power project that optimizes power generation efficiency and provides energy at a reasonable and competitive cost.
- Interconnect directly to the existing electrical transmission system near a major load center.
- Minimize environmental impacts, infrastructure needs, and costs by locating the plant near existing infrastructure (such as a transmission line, a substation, a natural gas pipeline, an adequate water supply, and highways and access roads) and by using designated utility corridors to the maximum extent possible.
- Develop a solar power project that will qualify for and benefit from tax benefits and other incentives available to solar/renewable projects.

Between 1980 and 2007, Arizona's population increased by nearly 137%. Between 2008 and 2032, the state's population is projected to increase an additional 65%, with demand for electricity growing similarly (Arizona Investment Council 2008). Arizona is a state with abundant sunshine, and the development of utility-scale solar energy is needed to meet the state's renewable energy requirements.

1.2.1 SSEP Overview

Boulevard is proposing to construct a 375-MW solar thermal energy plant that would include the proposed power blocks, solar field, evaporation ponds, HTF land treatment areas, and all ancillary facilities. The SSEP would use a parabolic trough solar thermal technology to produce electrical power using steam turbine generators fed by solar steam generators. The SSEP would also use natural gas–fueled boilers or heaters for additional power generation and HTF freeze protection heaters. Thermal energy storage would be used at each of the two plants; would consist of a molten salt, two-tank design; and would provide several hours of storage for each plant. The purpose of gas backup and thermal energy storage systems is to increase daily hours of operation, shift energy production into peak periods, and make up production during periods of extended cloud cover. The SSEP would consist of two solar thermal power block units. A 125-MW unit would produce approximately 290,000 MW hours (MWh) per year, and a 250-MW unit would generate approximately 580,000 MWh per year. The entire facility would operate for 30 years or more. Boulevard would phase construction so that the 125-MW unit, located on the east side of the facility, would be operational approximately one year before the separate 250-MW unit is operational.

1.2.2 Location, Acreage, and General Dimension of the SSEP Facilities

The SSEP would be located in the west end of the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills and the Town of Buckeye, Arizona (Map 1). The SSEP facilities would occupy approximately 3,620 acres and would be located almost entirely on BLM-administered lands (Map 1; Table 1.1).

Table 1.1 Legal Description of the Sonoran Solar Energy Project

Ownership	Township and Range	Section	Acreage
BLM	T2S R2W	28	1.681
		29	18.414
		30	14.651
		31	1.895
		32	2.146
		33	2.420
	T2S R3W	12	78.008
		13	600.910
		14	347.597
		15	247.591
		16	0.230
		19	6.184
		20	12.855
		21	143.546
		22	545.739
		23	639.715
		24	635.708
		25	233.328
		26	70.574
		36	5.150
	T2S R4W	24	0.020
		Subtotal	*3,608.372*
Private	T2S R2W	27	0.0103
		28	0.771
		33	1.186
		34	0.060
	T2S R4W	24	4.013
		Subtotal	*6.041*
State	T2S R4W	23	0.614
		24	1.159
		25	2.144
		26	1.315
		Subtotal	*5.234*
		Total	**3,619.648**

Note: T=Township; R=Range

1.2.3 Federal Renewable Energy Policy

As part of an overall strategy to develop a diverse portfolio of domestic energy supplies for our future, the National Energy Policy of 2001 and the Energy Policy Act of 2005 (Public Law [P.L.] 109-58, August 8, 2005) encourage the development of renewable energy resources, which includes solar energy. Section

211 of the Energy Policy Act of 2005 encourages the approval of at least 10,000 MW of nonhydropower renewable energy projects on public lands nationwide within the next 10 years. In EO 13212 (May 18, 2001), the President ordered that executive departments and agencies take appropriate actions "to expedite projects that will increase the production, transmission, or conservation of energy." Similarly, Secretary of the Interior Order 3285 (March 11, 2009) encourages the production, development, and delivery of renewable energy as one of the DOI's greatest priorities.

In response, the BLM established their Solar Energy Development Policy (IM No. 2007-097). This policy directs the BLM to facilitate environmentally responsible commercial development of solar energy projects on public lands and to use solar energy systems on BLM facilities where feasible. Applications for commercial solar energy facilities are processed as ROW authorizations under Title V of FLPMA and 43 CFR § 2804. ROW applications for solar energy development projects are identified as a high priority workload and are to be processed in a timely manner. This priority is consistent with the above laws and Secretarial Order.

The SSEP would support the President's New Energy for America Plan, which sets a target of ensuring that 10% of United States electricity is generated from renewable sources by 2010, rising to 25% by 2025. In order to meet these requirements, renewable energy projects need to be constructed and brought online. The American Recovery and Reinvestment Act of 2009 (also known as the economic stimulus plan) also promotes increased renewable energy availability.

1.3 Purpose and Need

The BLM's purpose and need for this action is to respond to Boulevard's application under Title V of FLPMA (43 U.S.C. § 1761) for a ROW grant to construct, operate, maintain, and decommission a solar power plant[1] and ancillary facilities in compliance with FLPMA, BLM ROW regulations, and other applicable federal laws. The BLM will decide whether to approve, approve with modification, or deny issuance of a ROW grant to Boulevard for the proposed solar energy project.

1.3.1 Purpose of the Action

Specifically, the BLM's purposes in considering the SSEP are as follows:

- To meet public needs for use authorizations, such as ROWs, permits, leases, and easements, while avoiding or minimizing adverse impacts to other resource values and locating the uses in conformance with LUPs. Section 211 of the Energy Policy Act of 2005 (119 Stat. 594, 660) and the BLM's Solar Energy Development Policy establish a framework to process applications for ROWs and direct the BLM to be responsive to solar energy project applicants while protecting the environment.

[1] The purpose and need was changed under the BLM's authority as the lead federal agency for this action to be more inclusive of other solar power options considered in the final EIS by removing the terms "concentrated" and "thermal" from the description.

- To implement FLPMA and the *Lower Gila South Resource Management Plan* (BLM 1988), as amended (BLM 2005a, BLM 2009a), by providing consistent land management decisions based on the standards set forth by both authorities. Both authorities recognize that the Project Area is available for multiple uses.
- To process ROW application AZA-34187 submitted by Boulevard in an expeditious manner consistent with both EO 13212 (Actions to Expedite Energy-Related Projects) and mandates of the Energy Policy Act of 2005 and the American Recovery and Reinvestment Act of 2009.

1.3.2 Need for the Action

The BLM's needs in considering the Proposed Action are as follows:

- Grant ROWs for "systems for generation, transmission, and distribution of electric energy" and/or "other necessary. . .systems or facilities which are in the public interest," under Title V of FLPMA (43 U.S.C. §§ 1761–1771).
- Support the President's New Energy for America Plan, which sets a target of ensuring that 10% of United States electricity is generated from renewable sources by 2012, rising to 25% by 2025.
- Further the purpose of Secretarial Order 3285A1 (March 11, 2009), which "establishes the development of environmentally responsible renewable energy as a priority for the Department of the Interior" (BLM IM No. 2011-059).

1.4 Scope of the Analysis

1.4.1 The EIS Decision Framework

NEPA requires federal agencies, in their decision-making processes, to consider the impacts of their proposed actions on the human environment and to consider reasonable alternatives to those actions. The intent of NEPA analyses is to disclose the effects of federal actions and to inform agency decision makers. To meet NEPA requirements federal agencies must prepare a detailed statement—in this case an EIS—describing the direct, indirect, and cumulative effects of their proposed actions and alternatives to those actions on the human environment. The EIS must also describe 1) any unavoidable or residual (i.e., not able to be mitigated), adverse impacts as a result of implementing the Proposed Action or alternatives; 2) the relationship between the short-term uses of the land (i.e., the Proposed Action and alternatives) and the long-term productivity of the human environment; and 3) any irreversible and irretrievable commitments of resources as a result of implementing the Proposed Action or alternatives.

The preparation of an EIS is a process consisting of the following general steps:

- Issue the NOI to prepare an EIS
- Conduct public and agency scoping
- Prepare and issue the draft EIS
- Conduct public review and comment on the draft EIS
- Prepare and issue the final EIS, including responses to comments
- Hold a 30-day waiting period
- Issue the ROD

This EIS analyzes and discloses the environmental impacts of the Proposed Action, the No Action, and three other action alternatives (all alternatives are described in detail in Chapter 2). It is intended to encourage public participation in the BLM's decision-making process. It provides an analysis of impacts that would result from the implementation of the Proposed Action and other alternatives, and it identifies mitigation measures to address environmental consequences. This EIS does not contain final decisions regarding the Proposed Action or other alternatives.

1.4.2 Decisions to be Made Through this EIS

Decisions made regarding the Proposed Action and alternatives will be documented in a ROD signed by the authorized officer (AO), the District Manager for the BLM Phoenix District. The BLM decision will apply only to public lands.

In the ROD, the BLM Phoenix District Manager will determine the following:

- Whether the analysis contained in this EIS is adequate for the purposes of reaching an informed decision regarding the ROW application
- Whether to approve the Proposed Action, select a different alternative, select a combination of alternatives, or deny the ROW request
- Whether the Proposed Action and alternatives are in conformance with applicable land and resource management plans
- Appropriate terms and conditions (including mitigation and monitoring requirements), if the ROW is approved

Further, a plan of development (POD) and constituent plans will be referenced in the ROD and attached as an appendix to the ROD.

1.5 Public and Agency Scoping

1.5.1 Process

Scoping is conducted early in the NEPA process to identify substantive issues for analysis in the preparation of an EIS. During the scoping period, the lead agency solicits, organizes, and analyzes comments submitted by agencies and the public. Issues and concerns specific to a project that will need to be addressed are then identified, and the agency determines the method by which the issues will be addressed through the EIS process.

The BLM has conducted internal, agency, and public scoping to solicit input and to identify the environmental concerns and issues associated with the SSEP. An NOI was published in the *Federal Register* on July 8, 2009. The BLM then prepared scoping information materials and provided copies to federal, state, and local agencies; Native American tribes; and members of the general public. Upcoming meetings and opportunities to comment were announced in various local news media. The BLM conducted open houses to disseminate information, answer questions, and ask for comments on August 4, 2009, in Phoenix, Arizona; on August 5, 2009, in Buckeye, Arizona; and on August 6, 2009, in Gila Bend, Arizona. The BLM also provided opportunities for comments to be submitted through the United States mail and by email.

The issues identified during the scoping process are summarized in the section below.

1.5.2 Issues Identified during Scoping

This section summarizes the relevant issues and concerns related to the SSEP that were identified through the public scoping process and that are addressed in this EIS. Table 1.2 outlines the sections of the EIS that address these issues.

1.5.2.1 PROCESS ISSUES

- Which tribes will be consulted as part of the required government-to-government consultation? How would construction and operation of the solar-powered electricity-generating facility (solar facility) affect the interests and concerns of Native American people?
- Have the USFWS and the AZGFD been consulted regarding how construction and operation of the SSEP would affect wildlife, including threatened, endangered, and sensitive species, and their habitat?
- Has the USACE been consulted regarding how construction and operation of the SSEP would affect waters of the United States?
- How will other federal, state, and local agencies; interest groups; and individuals be involved as stakeholders?
- What additional permits will be needed for construction and operation of the solar facility?

1.5.2.2 PURPOSE AND NEED ISSUES

- What effect would construction and operation of the solar facility have on continued use of fossil fuels for electrical generation?
- What energy market would this solar facility serve?

1.5.2.3 ALTERNATIVES ISSUES

- What is the desired energy profile (capacity factor and time of energy output) for the SSEP, and is it supported by the purpose and need of the SSEP?
- What other Project Area configurations or technologies would meet the SSEP purpose and need and reduce impacts to resources?
- Are there other locations for the SSEP that would reduce potential use conflicts and meet the SSEP purpose and need, even if they are not located on public land?
- Would residential and wholesale-distributed generation, in conjunction with energy efficiency practices, be a viable alternative to the proposed SSEP?

1.5.2.4 RESOURCE AND IMPACTS ANALYSIS ISSUES

1.5.2.4.1 Air Quality Issues

- What effect would construction and operation of the solar facility have on local air quality?
- What is the SSEP's projected use of natural gas? Within the constraints of the desired energy profile (capacity factor and time of energy output), what opportunities exist to reduce impacts to air quality through operational changes such as the inclusion of a thermal storage unit?
- What effect would inclusion of a thermal storage unit have on reducing emissions from natural gas-fired electrical generation?

- What effect would expansion of the solar field to replace the thermal input provided by gas have on reducing emissions or on other resources?
- What opportunities exist to reduce impacts to air quality through mitigation plans (e.g., fugitive dust control and equipment emissions mitigation plans)?

1.5.2.4.2 Climate Change Issues

- What is the full carbon footprint of the proposed SSEP, and which phases of the SSEP are appropriate to include in that analysis?
- Against what other energy-generation types should the SSEP's GHG footprint be measured to determine the net GHG reductions or gains?
- Could the SSEP be designed in a way to reduce the impact to carbon sequestration?
- How should potential change in climate be measured and quantified in the EIS?
- How might anticipated change in climate affect the Project Area's resources and sensitive areas? How would this affect the operation of the proposed SSEP?
- How might climate change affect cumulative impacts?

1.5.2.4.3 Cultural Resources Issues

- How would construction and operation of the solar facility affect cultural resources, including the physical integrity of sacred sites?

1.5.2.4.4 Geology and Minerals

- What effect would construction and operation of the SSEP have on landforms and subsurface geology in the Project Area?
- How would construction and operation of the SSEP impact mineral resources and their availability for use?

1.5.2.4.5 Hazardous Materials and Hazardous and Solid Waste Issues

- How would waste generated during construction and operation of the solar facility be managed (i.e., storage and disposal)?

1.5.2.4.6 Land-use and Access Issues

- What effect would construction and operation of the solar facility have on existing land uses in and adjacent to the Project Area, including master-planned communities, the Hidden Valley transportation system, a sand and gravel operation, and military air space?
- What effect would construction and operation of the solar facility have on proposed land uses in and adjacent to the Project Area, including the land-use objectives of federal, state, tribal, and local plans and policies?

1.5.2.4.7 Livestock Grazing

- What effect would construction and operation of the SSEP have on ephemeral grazing allotments in the area (i.e., the Beloat grazing allotment and Arnold grazing allotment)?

1.5.2.4.8 Mitigation Issues

- What opportunities exist for on-site mitigation of impacts to other resources and values?
- What opportunities exist to ensure adequate funds will be available for complete restoration of the Project Area after the SSEP is retired or abandoned?

1.5.2.4.9 Noise Issues

- What effect would construction and operation of a solar facility have on the soundscape in nearby residential communities?
- What effect would construction and operation of a solar facility have on the experience of visitors to the adjacent wilderness?

1.5.2.4.10 Paleontology Issues

- Would construction of the SSEP result in the discovery or destruction of paleontological resources in the area?

1.5.2.4.11 Recreation and Wilderness Characteristics Issues

- What effect would construction and operation of the solar facility have on the suitability and availability of surrounding public lands and access roads for recreation purposes?
- There is an area adjacent to the SSEP to the south that may have wilderness characteristics. How would the construction and operation of the solar facility impact the potential wilderness characteristics of this area?

1.5.2.4.12 Socioeconomic Issues

- What employment opportunities would be provided by construction and operation of the solar facility?
- What contribution would construction and operation of the solar facility have on local revenue and the economy?
- What effect could the solar facility have on minority and low-income populations?
- What effect could the solar facility have on local services such as emergency medical treatment and police response?

1.5.2.4.13 Soils Issues

- What effect would the construction and operation of the solar facility and associated facilities have on soils in the Project Area, including cryptobiotic crust, cyanobacteria, mosses, and lichens?
- What measures can be taken to reduce impacts to drainage, erosion, and sediment control?

1.5.2.4.14 Special Designation Issues

- What effect would construction and operation of the solar facility have on the resource values and experience of visitors to the adjacent wilderness?

1.5.2.4.15 Threatened, Endangered, and Special-status Species Issues (plants and animals)

- What effect would the construction and operation of the solar facility and associated facilities have on local populations of ESA-listed or candidate species or other special-status species and suitable habitats, including
    - impacts to suitable upland, riparian, wetland, or aquatic (Gila River) habitat and
    - impacts to species that are listed or candidates for listing under the ESA, or are otherwise designated as a sensitive species, including Tucson shovel-nosed snake, Sonoran desert tortoise, yellow-billed cuckoo, Yuma clapper rail, southwestern willow flycatcher, California barrel cactus, least bittern, and western burrowing owl.
- What measures can be taken to reduce the adverse impacts?

1.5.2.4.16 Transportation and Traffic Issues

- What effect would construction and operation of the solar facility have on the operation of planned or existing transportation or utility systems and facilities?
- What effect would construction and operation of needed utilities for the solar facility have on existing and proposed transportation systems?
- What effect would the solar facility have on access to local private and public lands?

1.5.2.4.17 Vegetation Issues

- What effect would the construction and operation of a solar facility and associated facilities have on native plants, including
    - loss of native vegetation from direct disturbance (e.g., grading the proposed Project Area),
    - increased shade from the installation of equipment, and
    - introduction and spread of invasive plant species into the Project Area?
- Can plant loss be mitigated by salvage and reuse or replanting of native plants in the Project Area?

1.5.2.4.18 Visual Resources Issues

- What effect would construction of a solar facility have on the scenic quality and undisturbed character of the area?
- How would the character of the viewshed from KOPs in the Sonoran Desert National Monument and the North Maricopa Mountains Wilderness be modified by the construction and operation of a CST power generating facility?
- What would be the cumulative effect to visual resources (the scenery) visible from KOPs along Arizona highways from the construction and operation of the solar facility if all of the approximately 35 ROWs for similar facilities are approved?
- What measures can be taken to reduce the impacts?

1.5.2.4.19 Water Resources Issues

- How would the withdrawal of groundwater from the Project Area impact
  - the quantity and quality of water in the aquifer under the City of Goodyear, including the flow of lower-quality water into the aquifer from the waterlogged area near the Gila River;
  - the quantity of water available for use by the Buckeye Hills Regional Park;
  - the quantity and quality of water in existing private wells in the area;
  - the water table in Rainbow Valley; and
  - the aquatic habitats, springs, soils, and land surface (e.g., subsidence)?
- What measures can be taken to prevent further degradation of impaired waters?
- How would the permitting process for the SSEP impact existing water rights?
- What methods could be used to reduce the amount of groundwater needed for the SSEP, and what would be the impact on the quantity and quality of surface water and groundwater resources if these methods were implemented?
- How would construction and operation of the solar facility impact the quality of existing surface water or groundwater?
- How would construction and operation of the solar facility impact existing Project Area drainage patterns, including floodplains and washes?
- What would be the cumulative impact on the local hydrographic basin from the development and use of local water sources to meet SSEP water demands?
- How would the concentrated dewatered waste from evaporation ponds, TDS, nitrates, boron, and salt be disposed of?
- What effect would groundwater pumping to supply water for the solar facility have on area aquifers?
- What effect would other solar-powered electricity-generation technologies have on use and conservation of water?

1.5.2.4.20 Wildlife Issues

- To what extent does modification to the landscape in the Project Area's boundary impact adjacent habitat?
- Would disruptions in surface flows in washes and uplands lead to broad-scale mortality of vegetation and impact wildlife distribution and abundance beyond the SSEP footprint?
- What effect would the construction and operation of the solar facility and associated facilities have on local wildlife populations and individuals, including
  - disruption of north-south movements of wildlife between the Maricopa Mountains and the Buckeye Hills;
  - disruption of the regional landscape of wildlife linkages between the Gila Bend Mountains, the Sierra Estrella range, and the Gila River;
  - impacts to individual animals and populations as a result of increased shade introduced into the environment from the installation of equipment;
  - impacts to wildlife species, particularly migratory waterfowl, as a result of exposure to contaminants in evaporation ponds or stormwater detention basins;
  - impacts to wildlife species near the Gila River; and
  - impacts to desert bighorn sheep historical habitat and reintroduction plans?

1.5.2.4.21 Cumulative Impacts Issues

- What would be the cumulative effects of other solar-powered electricity-generating facilities being considered in western Arizona, California, and Nevada on the Sonoran Desert landscape?
- What past, present, and reasonably foreseeable projects and their connected actions (i.e., transmission needs and associated projects) would be appropriate to include in a cumulative impacts analysis?
- What resources are appropriate to include in a cumulative impacts analysis? What are appropriate impact indicators and information to include in that analysis?
- How might climate change affect the cumulative impacts of these facilities on the Sonoran Desert?

Table 1.2 How and Where Issues are Addressed in the EIS

Issue Category	How or Where Issues are Addressed	Section(s)
Process	Described in Chapters 1 and 5	Chapters 1 and 5, all sections
Purpose and need	Addressed in the Purpose and Need section	Section 1.3
Alternatives	Incorporated into the range of alternatives in Chapter 2	Chapter 2, all sections
Resource and impacts analysis		
Air quality	Analyzed in Air Quality sections	Sections 3.2 and 4.2
Climate change	Analyzed in Climate Change sections	Sections 3.3 and 4.3
Cultural resources	Analyzed in Cultural Resources sections	Sections 3.4 and 4.4
Geology and minerals	Analyzed in Geology and Minerals sections	Sections 3.5 and 4.5
Hazardous materials and hazardous and solid waste	Analyzed in Hazardous Materials sections	Sections 3.6 and 4.6
Land use and access	Analyzed in Land Use and Access sections	Sections 3.7 and 4.7
Livestock grazing	Analyzed in Livestock Grazing sections	Sections 3.8 and 4.8
Mitigation	Some actions with mitigative effects included as actions common to each alternative and applicant-committed measures Potential mitigation proposed and analyzed for all resource sections	Section 2.3 Chapter 4 (all sections)
Noise	Analyzed in Noise sections	Sections 3.9 and 4.9
Paleontology	Analyzed in Paleontology sections	Sections 3.10 and 4.10
Recreation and wilderness characteristics	Analyzed in Recreation and Wilderness Characteristics sections	Sections 3.11 and 4.11
Socioeconomics	Analyzed in Socioeconomics sections	Sections 3.12 and 4.12
Soils	Analyzed in Soils sections	Sections 3.13 and 4.13
Special designations	Analyzed in Special Designations sections	Sections 3.14, 4.14
Threatened, endangered, and special-status species (plants and animals)	Analyzed in Wildlife and Special-status Species and Vegetation and Special-status Species sections	Sections 3.16, 3.19, 4.16, and 4.19
Transportation and traffic	Analyzed in Transportation and Traffic sections	Sections 3.15 and 4.15

Table 1.2 How and Where Issues are Addressed in the EIS

Issue Category	How or Where Issues are Addressed	Section(s)
Vegetation	Analyzed in Vegetation and Specialist Status Species sections	Sections 3.16 and 4.16
Visual resources	Analyzed in Visual Resources sections	Sections 3.17 and 4.17
Water resources	Analyzed in Water Resources sections	Sections 3.18 and 4.18
Wildlife	Analyzed in Wildlife and Special-status Species sections	Sections 3.19 and 4.19
Cumulative impacts	Analyzed for all resources under Cumulative Impacts section	Section 4.20

*These issues were also considered in the development of a reasonable range of alternatives.

1.5.3 Nonsubstantive Issues Identified in Scoping

Table 1.3 summarizes the nonsubstantive issues and concerns that were identified through the public scoping process but that are not addressed in the EIS. Table 1.3 also states the reasons these issues and concerns are not addressed or analyzed.

Table 1.3 Issues Not Addressed in the EIS

Issue	Why Issue is Not Addressed
What SSEP-specific opportunities are available to educate the public of the value and importance of solar energy; the effects of solar energy production on natural, cultural, and human resources; and conservation of natural resources?	The proposed public education is beyond the scope of the EIS and its analysis. Although the EIS process requires disclosure of project impacts, it does not require public education of the type proposed.
In the context of the SSEP, what opportunities exist to streamline the NEPA and permitting processes? Can the solar project criteria development of other renewable energy multistakeholder processes be used to facilitate timely development?	The EIS process is subject to the provisions of NEPA, the implementing regulations (40 CFR §§ 1500–1508), and the BLM NEPA Handbook (H-1790-1), all of which require a specific analysis process with minimum timeframes.
How will the EIS analysis team coordinate with Maricopa County to ensure that the portions of the Project Area that occur in unincorporated Maricopa County are properly entitled and permitted prior to construction or operation?	Maricopa County has been invited to participate in the EIS process (see Chapter 5). Although the analysis of this EIS may be used in obtaining needed permits for construction and operation of the SSEP, the needed titles, permits, and authorizations have specific legal and regulatory requirements that are separate from the requirements to prepare an EIS. If a ROW is authorized, compliance with federal, state, and local permitting would be a term and condition of BLM's authorizations for the project. See Table 1.5, below.

1.6 Relationship to Policies, Plans, and Programs

The preparation of this EIS is in accordance with NEPA and in compliance with the CEQ regulations (40 CFR §§ 1500–1508), DOI requirements (Department Manual 516), and guidelines listed in the BLM NEPA Handbook, H-1790-1.

The Proposed Action must comply with various federal laws, statutes, regulations, and EOs (Table 1.4). FLPMA mandates that the BLM manage public lands on the basis of multiple use and sustained yield (43 U.S.C. § 1701[a] [7]).

Table 1.4 Federal Laws, Statutes, Regulations, and Executive Orders with which the Proposed Action and all Alternatives must Conform

Federal Laws and Statutes
American Indian Religious Freedom Act of 1978 (P.L. 95-341; 42 U.S.C. § 1996)
Archaeological and Historic Data Preservation Act of 1974 (P.L. 86-253, as amended by P.L. 93291; 16 U.S.C. § 469)
Archaeological Resources Protection Act of 1979 (P.L. 96-95; 16 U.S.C. §§ 470aa–mm)
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. §§ 668–668d, 54 Stat. 250) as amended (P.L. 95-616 (92 Stat. 3114)) November 8, 1978
Clean Air Act (CAA) of 1990 (as amended by P.L. 92-574; 42 U.S.C. § 4901)
Colorado River Basin Salinity Control Act of 1974 (P.L. 93-320)
Department of Transportation Act of 1966 (P.L. 89-670; 49 U.S.C. § 303)
Endangered Species Act of 1973 (P.L. 85-624; 16 U.S.C. §§ 661, 664, 1008)
Energy Policy Act of 2005 (P.L. 109-59)
Farmland Protection Policy Act (P.L. 97-98 and 7 CFR § 658)
Federal Land Policy and Management Act of 1976, § 201(a) (P.L. 94-579; 43 U.S.C. § 1701 et seq.)
Federal Water Pollution Control Act of 1972, Section 404 (P.L. 92-500; 33 U.S.C. § 1344, as amended)
Historic Sites Act of 1935 (P.L. 292-74; 16 U.S.C. §§ 461–467)
Land and Water Conservation Fund Act of 1965 (P.L. 88-578)
Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712, as amended)
National Environmental Policy Act of 1969 (P.L. 91-190; 42 U.S.C. § 4321)
NHPA of 1966, Section 106, (P.L. 89-665; 16 U.S.C. § 407(f))
Native American Graves Protection and Repatriation Act of 1990 (P.L. 101-601)
Executive Orders
EO 11296, Flood Hazard Evaluation Guidelines
EO 11514, Protection and Enhancement of Environmental Quality
EO 11593, Protection and Enhancement of the Cultural Environment
EO 11644, Use of offroad vehicles on the public lands (as amended by EOs 11989 and 12608)
EO 11988, Floodplain Management (43 CFR § 6030)
EO 11990, Protection of Wetlands
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations
EO 13007, Indian Sacred Sites
EO 13175, Consultation and Coordination with Indian Tribal Governments
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds
EO 13212, Actions to Expedite Energy-related Projects
EO 13287, Preserve America
EO 12372, Intergovernmental Review of Federal Programs

Table 1.4 Federal Laws, Statutes, Regulations, and Executive Orders with which the Proposed Action and all Alternatives must Conform

Federal Regulations
40 CFR §§ 1500–1508, CEQ implementation of NEPA
33 CFR §§ 320–331 and 40 CFR § 230, Section 404 of the Clean Water Act (CWA) and Its Implementing Regulations
36 CFR § 800, as amended, Protection of Historic Properties
7 CFR § 658, as amended, Prime and Unique Farmlands
43 CFR § 2800, as amended, ROWs Principles and Procedures

1.6.1 BLM Land-use Plan

The Proposed Action would take place in the Lower Gila South Planning Area. This planning area is managed under the *Lower Gila South Resource Management Plan* (BLM 1988), as amended (BLM 2005a, BLM 2009a), which is currently being revised. The RMP allows for multiple uses of public lands and does not prohibit the development of alternative energy sources on public lands. Although the Proposed Action and alternatives are not specifically mentioned in the plan, they are consistent with the plan's objectives, goals, and decisions. A BLM team completed an LUP conformance analysis on November 21, 2008, and determined that the Proposed Action would not conflict with other decisions throughout the plan. No alternatives that would conflict with the plan have been considered.

1.6.2 County and Local Plans

The Proposed Action is consistent with the *Maricopa County Comprehensive Plan* (Maricopa County 2002). In this plan, the county has outlined an objective to "support innovative technological operations and facilities to encourage an appropriate balance of automobile use and to encourage energy efficiency and the use of renewable resources." The Proposed Action and alternatives presented in this EIS are consistent with the goals of the *Maricopa County Comprehensive Plan* because the Proposed Action and alternatives would result in the use of renewable resources.

Although the Proposed Action and alternatives would not take place on lands where the City of Goodyear has jurisdictional authority, they are consistent with the City of Goodyear's plan because the plan encourages energy conservation and a balance between suburban and urban development, which would allow a solar-powered facility. The goals, objectives, and policies contained in the *City of Goodyear General Plan* (City of Goodyear 2003) note a desire to "strike the necessary balance between suburban and urban development while retaining the elements of the City's agricultural and natural character." The city's plan further notes that "Environmental and Energy Conservation projects would be considered even if baseline densities were exceeded."

Goal 10.0 ("Use Energy Efficiently and Maximize Sustainability") of the *Town of Buckeye General Plan* (Town of Buckeye 2008a) encourages the use and development of renewable energy sources, such as solar and wind. Because they consider the construction and operation of a solar-powered electricity-generating facility, the Proposed Action and alternatives are consistent with the town's plan.

1.6.3 State of Arizona

The Arizona Corporation Commission establishes jurisdiction for the siting of thermal power plants larger than 100 MW and transmission lines with a voltage higher than 115 kilovolts (kV). The process is formally outlined in Arizona Revised Statues (A.R.S.) §§ 40-360 through 40-360.13 and A.A.C. R14-3-201–220. The process for permitting has two phases: 1) the receipt of a CEC from the Power Plant and Transmission Line Siting Committee (committee) and 2) an order approving the CEC from the Corporation Commission (commission).

Applicants are required to file an application after they have filed both a ten-year transmission plan and a power plant plan. For a project of this type, the applications would be processed concurrently.

Following the submission of an application, the committee will convene a series of hearings conducted before a quorum of its members, generally adhering to administrative hearing protocols (opening, sworn witnesses, cross examination, introduced exhibits). The proceedings are transcribed by a court reporter. The applicant has the opportunity to present an overview of its proposals. Intervention is generally open to any interested party; however, nonindividual parties (e.g., corporations, partnerships) must be represented by counsel. The committee also accepts unsworn public comments from interested people, other than parties. At the end of the hearing process, the applicant will propose a form or CEC, which will be subject to the input of the interveners. The committee may propose its own amendments.

Upon approval by a vote of the committee, the CEC is referred to the commission for phase two of the process. Before the five commissioners, the committee chairperson will introduce the project, and the commission will then hear additional, unsworn public comment and any further testimony from the applicant or other parties. The commissioners will hold discussions on additional conditions or changes to the CEC and take a final vote. Upon an affirmative vote on the amendments and the order, the commission will issue an order approving the CEC, as amended. From start to finish, this process can take up to approximately nine months to complete.

CEC is an independent permitting process from the BLM ROW approval considered in the EIS, and it is currently underway. Arizona Corporation Commission's approval of the CEC would be required before project implementation.

The Arizona Corporation Commission's Renewable Energy Standard and Tariff Rules (A.A.C. R14-2-1801–1815), along with other renewable energy mandates, call on the state's electric utilities to produce 15% of their electricity from renewable sources by 2025. The Proposed Action and alternatives would assist the state's electric utilities in meeting this goal and would therefore be consistent with State of Arizona objectives vis-à-vis renewable energy development.

1.6.4 Permits, Licenses, Approvals, Compliance, or Reviews Required or Potentially Required

To implement any of the action alternatives analyzed in this EIS, the proponent must acquire applicable federal, state, county, and local permits and other approvals, as necessary. Applicable or potentially applicable approvals (permits, licenses, compliance, or reviews) are listed in Table 1.5.

Table 1.5 Permits, Licenses, Approvals, Compliance, or Reviews Potentially Required under the Proposed Action and All Action Alternatives

Permit, License, Approval, Compliance, or Review	Issuing Agency	Action Requiring Permit, License, Approval, Compliance, or Review
Federal		
Temporary land-use permit or ROW	BLM	Solar meter installation, temporary geotechnical or groundwater exploratory, or other pre-operational activities on BLM land
ROW grant on federal lands and NEPA ROD	BLM	Commercial solar-powered facility development on BLM land
Section 106 consultation	BLM, SHPO	Potential to disturb historic and archaeological resources
Section 7 consultation	BLM, USFWS	Potential to impact listed species
Approved JD	USACE	Can request an approved JD to determine whether a Section 404 Individual permit is needed
Individual permit under Section 404 of the CWA	USACE	Discharges of dredged or fill material into waters of the United States (includes wetlands and dry desert washes)[1]
Conditional letter of map revision (CLOMR) or letter of map revision (LOMR)	Federal Emergency Management Agency (FEMA)	Rerouting of a wash that may alter the National Flood Insurance Program map
State		
CEC[3]	Arizona Corporation Commission	Thermal power plant ≥ 100 MW and construction of transmission line ≥ 115 kV
NOI to drill nonexempt well	ADWR	Any new water supply well that will produce groundwater at a rate greater than 35 gallons per minute
General Industrial Use (GIU) Permit[2]	ADWR	Groundwater development in the Phoenix Active Management Area will require either a grandfathered groundwater right or a GIU permit to legally withdraw groundwater.
Hydrologic Testing Permit	ADWR	Required for each well to withdraw groundwater for hydrologic testing purposes
Water quality certification under Section 401 of the CWA	Arizona Department of Environmental Quality (ADEQ)	Any applicant for a federal license or permit who conducts activity that may result in a discharge to waters of the state must provide the licensing or permitting agency a certification that the activity complies with water quality requirements and standards.
Section 402 Arizona Pollutant Discharge Elimination System (AZPDES) General Permit for Stormwater Discharges from Construction Activities	ADEQ	Discharges associated with construction activities that disturb one or more acres of land. This permit is issued under authority of the Federal Water Pollution Control Act and requires a Stormwater Pollution Prevention Plan (SWPPP), BMP, and a NOI (construction). Requires the generation of a SWPPP.
AZPDES De Minimus General Permit for Off-site Discharge of Water	ADEQ	An NOI to Discharge must be filed and a Discharge Authorization issued before groundwater produced during drilling or well development, or both, can be discharged off-site.
Individual aquifer protection permit (APP)[3]	ADEQ	An area-wide APP will be required for the evaporation ponds and possibly the land treatment unit for soils impacted by HTF.

Table 1.5 Permits, Licenses, Approvals, Compliance, or Reviews Potentially Required under the Proposed Action and All Action Alternatives

Permit, License, Approval, Compliance, or Review	Issuing Agency	Action Requiring Permit, License, Approval, Compliance, or Review
Drinking Water Distribution System Plan	ADEQ	A plan review will be required prior to adoption of a new drinking water distribution system. Approval may also be required by ADEQ's Capacity Assurance Development Program.
Grant for permission to disturb	ASM	Potential disturbances to human remains or funerary objects
Local		
Floodplain Use Permit	Maricopa County Flood Control District	Construction activities in a FEMA-defined floodplain
Type 4.02 or 4.23 general APP	Maricopa County Environmental Services Department (authorized by ADEQ)	**For the 4.02 Permit**: Septic tank with disposal by trench, bed, chamber technology, or seepage pit, less than 3,000 gallons per day (gpd) design flow. **For 4.23 Permit**: If septic system exceeds 3,000 gpd (permit type will depend on the type of system selected; the design requirements for each type of system are prescribed in the rules. A percolation test will have to be conducted at some point as part of the design, before submitting an application).
Dust Control Permit	County (Maricopa) Air Quality Department	Fugitive dust (particularly PM_{10} because Maricopa County is a serious nonattainment area for PM_{10}) as a result of 1) ground-disturbing activities during construction and 2) barren surfaces during normal operation and maintenance.
Drinking Water Distribution System Plan	Maricopa County Environmental Services Department	A plan review will be required prior to adoption of a new drinking water distribution system.
Title V Air Quality Operating Permit[3]	County (Maricopa) Air Quality Department and U.S. Environmental Protection Agency (EPA)	Natural gas back-up of solar thermal plant

[1] Must be acquired if washes are determined to be jurisdictional.

[2] If a groundwater exploratory drilling program is necessary, three additional permits for drilling are required.

[3] Would not be required under Sub-alternative A1.

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CHAPTER 2.
PROPOSED ACTION AND ALTERNATIVES

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

NEPA requires federal agencies to consider and evaluate a reasonable range of alternatives for a proposed action. The range of alternatives must meet the BLM's purpose and need while also minimizing or avoiding environmental impacts. This range of reasonable alternatives is formulated to address issues and concerns raised by the public and by agencies during scoping. The alternatives represent other means (methods, processes, locations, times, sequences, etc.), besides the Proposed Action, of satisfying the stated purpose and need for the federal action. Reasonable alternatives are defined by the CEQ as those that are technically, economically, and environmentally practical and feasible. NEPA also requires that a No Action alternative be evaluated for comparison to the other alternatives analyzed in the EIS. If unreasonable alternatives or alternatives that do not meet the purpose and need are suggested, a detailed analysis of these alternatives is not required. However, the rationale for eliminating them from detailed analysis must be explained.

This chapter presents four alternatives, one sub-alternative, and two options that were considered in detail for this EIS:

- The No Action alternative
- The Proposed Action
- Alternative A: Reduced Water Use (dry-cooled CST)
- Sub-alternative A1: Photovoltaic
- Alternative B: Reduced Footprint
- Brine Concentrator Option
- Gen-tie Line Option

Alternatives A and B were developed in response to issues raised during the agency and public scoping process. These alternatives would generally incorporate the same construction, operational, decommissioning, and reclamation components as the Proposed Action, but would either use alternative cooling technology or a reduced plant size to address resource issues raised in scoping. Sub-alternative A1 was developed in response to agency and public comments on the draft EIS as an alternative to Alternative A for reducing water consumption. Sub-alternative A1 would use PV technology instead of solar thermal technology to reduce water use, to decrease the project footprint, and to avoid other sensitive resources raised as issues by the public and agency cooperators. The use of PV technology was originally eliminated from further analysis in the draft EIS due to technological and economic infeasibility. However, advancements in technology and changing market conditions have allowed a reconsideration of PV technology in the final EIS.

A supplemental EIS was not prepared because no supplemental documentation is needed for the BLM to make a reasoned decision between alternatives to the proposed federal action. Sub-alternative A1 would result in impacts either *within* the range of or *less than* those that would result from the alternatives considered in the draft EIS. Furthermore, Sub-alternative A1 was developed in direct response to public and agency comment on the draft EIS, and it was made possible by rapid advancements in PV technology.

Several other alternatives were identified and considered but were eliminated from detailed analysis. These alternatives are described in Section 2.11, which provides the rationale for eliminating them from detailed analysis.

The BLM has identified Sub-alternative A1 (which would use PV technology to reduce water consumption) as the agency-preferred alternative. This sub-alternative would reasonably accomplish the purpose and need for the federal action while fulfilling the BLM's statutory mission and responsibilities, giving consideration to economic, environmental, and technical factors. In particular, this sub-alternative best addresses public and agency concerns regarding groundwater use while meeting the purpose and need. Under Sub-alternative A1, approximately 33 acre-feet of groundwater reserves in the Rainbow Valley aquifer would be removed and used annually during operations. This is approximately 98% less than the estimated water requirements of the Proposed Action (the highest water use alternative, which would use wet-cooled solar thermal technology) and 72% less than the estimated water requirements of Alternative A (the lowest water use alternative after Sub-alternative A1, which would use dry-cooled solar thermal technology). No modeled detectable drawdown to previously existing wells would occur under Sub-alternative A1. In addition, the total estimated acreage of surface disturbance under Sub-alternative A1 (2,013 acres)—the least surface disturbance of all action alternatives—would be approximately 44% less than under the Proposed Action and approximately 15% less than under the reduced footprint of Alternative B. The smaller overall project footprint would also reduce adverse impacts to other resources and uses (e.g., wildlife, visual resources, soils, vegetation) compared to other action alternatives. Sub-alternative A1 would generate approximately 775,000 MWh per year of electricity, which is approximately 89% of the generation under the Proposed Action, 101% of the generation under Alternative A, and 144% of the generation under Alternative B.

Under the No Action alternative, the SSEP would not be developed in any configuration and existing land uses in the Project Area would continue as they are now.

2.2 Development of Alternatives

This section describes the method by which alternatives were initially identified to meet the purpose and need. To ensure a wide consideration of the possible range of alternatives, six primary categories of alternatives were identified for further consideration:

- The alternative of not pursuing the proposed energy development is required by NEPA (the No Action alternative).
- The use of other modes of generating solar electricity. It may be possible to use other means of generating electricity from solar energy.
- The use of alternate solar technology to reduce water use and other impacts.
- The use of alternative water sources. Alternative sources of water might be used to achieve the identified needs.
- Alternative layouts or sizes of the SSEP.
- Alternative locations for the SSEP.

An initial review of the broad range of alternatives, through these six categories, was conducted to identify those alternatives that were either not feasible or that clearly did not meet the purpose and need. Alternatives that might meet the purpose and need were carried forward for further evaluation relative to the applicable CEQ guidelines. Alternatives not carried forward to detailed analysis are described in Section 2.11.

2.3 Features, Management, and Considerations Common to Each Action Alternative

There are a number of management prescriptions and other considerations common to each action alternative for one or more of the following reasons: 1) they are already required by law or regulation for purposes of energy development; 2) they are BMPs or management techniques that could be readily applied to reduce impacts regardless of alternative; 3) they were developed to address issues specific to the Project Area and could be readily applied to reduce impacts regardless of alternative; 4) they pertain to actions and/or plans already occurring and/or over which the BLM has no jurisdiction; and 5) they pertain to BLM decisions related to the Project Area that are independent of decisions with respect to the action alternatives (i.e., BLM decisions regarding the action alternatives would not necessitate changes to decisions related to these items and vice versa).

2.3.1 Plan of Development

A POD would be required if the BLM decides to issue a ROW grant. Boulevard would prepare and submit a POD to the BLM that addresses all aspects of project development, including but not limited to road construction and maintenance; vegetation removal; natural, cultural, and biological resources mitigation and monitoring; and site reclamation. The POD would incorporate, as applicable, a variety of site-specific plans. Where applicable, these would be based on example plans developed as part of the *Draft Programmatic Environmental Impact Statement for Solar Development in Six Southwestern States* (BLM and DOE 2010). These may include a decommissioning and site reclamation plan; grading, drainage, erosion, and sedimentation control plan; vegetation management plan; habitat restoration and management plan; wildlife management plan; hazardous materials management plan; cultural resources management and mitigation plan; and visual restoration monitoring and compliance plan. These plans would be modified for the SSEP and incorporated into the POD, as appropriate.

2.3.2 Applicable Laws, Ordinances, Regulations, and Standards

Under all action alternatives, the proponent (Boulevard) would comply with all applicable LORS, and would obtain and meet the requirements of all needed permits. Because LORS are generally specific to a resource, they are generally presented in Chapter 3, which describes the current environment and its management. Where specific permit requirements would affect the environmental consequences to a particular resource, those requirements are discussed in Chapter 4.

All alternatives incorporate applicable BMPs and management stipulations from the *Lower Gila South Resource Management Plan* (BLM 1985), as amended (BLM 2005a; 2009a); these are described in Table 2.1 and included by reference. These stipulations would be included as conditions of approval for any ROW approved by BLM, and would be binding in the event that the facility were transferred or operated by another entity.

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Air Quality	None applicable
Climate Change	None applicable
Cultural Resources	
Cultural Resources (1985:12)	Before proposals involving surface disturbance or transfer of title are approved, site-specific cultural resource evaluations will be completed within areas which have not been previously evaluated for cultural remains. A Class I literature review, as well as a Class III intensive field inventory (or an adequate Class II sample survey) will be conducted, as appropriate.
Cultural Resources (1985:12)	If any historic or archaeological properties are found, their eligibility for inclusion in the National NRHP will be determined in consultation with the SHPO (36 CFR 63).
Cultural Resources (1985:12)	Whenever feasible, BLM will avoid impacts to cultural resources by redesigning or relocating the project. If impacts are unavoidable, BLM will consult with the SHPO to develop mitigating measures to reduce or eliminate adverse impacts to cultural resources. In addition, BLM will consult with appropriate Native American groups which have aboriginal or historic ties to lands within the project area concerning known areas of traditional cultural and/or religious significance.
Cultural Resources (1985:12)	Impacts to cultural resources will be mitigated before construction begins.
Cultural Resources (1985:12)	If buried cultural remains are found during construction, the construction in the area will stop and the BLM will be notified. BLM Manual 8141 (Arizona Supplement) provides details on agency-specific guidelines for both long-term and interim physical and administrative protection of cultural resources. These measures will ensure compliance with the National Historic Preservation Act of 1966 and the National Environmental Policy Act of 1969.
Geology and Minerals	None applicable
Hazardous Materials and Hazardous and Solid Waste	None applicable
Land Use and Access	None applicable
Livestock Grazing	None applicable
Noise	None applicable
Paleontology	None applicable
Recreation and Wilderness Characteristics	
Wilderness Resources (1985:11)	Public lands within areas added by congress to the National Wilderness Preservation System would be managed in compliance with BLM's Wilderness Management Policy and the Wilderness Act of 1964.
Recreation Program (1985:12)	The recreation program will continue to participate in environmental assessments and resource activity plans in order to address and mitigate impacts on recreation resources.
Recreation Program (1985:12)	Visual resource management [VRM], management of off-road vehicle (ORV) use and other recreation resource management will continue as recreation programs.
Recreation Program (1985:12)	Wilderness areas established by the U.S. Congress in the Lower Gila South area would be closed to motorized vehicle use.
Recreation and Off-highway Vehicles (2005:15)	Existing visual resource inventory classes of the RMP will be adopted as management classes.
Socioeconomics	None applicable
Soils	None applicable

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Special Designations	None applicable
Transportation and Traffic	None applicable
Vegetation and Special-status Species	
Protected Plants (1985:11)	Before construction or soil-disturbing activities are allowed, BLM conducted site evaluations for protected plants. If possible, projects are located to avoid impacts to large numbers of protected plants or their habitats. Where significant impacts to protected plants are possible, plants are salvaged and transplanted or the project is abandoned. BLM notifies the Arizona Commission of Agriculture and Horticulture 30 days in advance of actions that would affect plants protected under the Arizona Native Plant law (Arizona, State of, 1981).
Visual Resources	
Recreation Program (1985:12)	Visual resource management, management of ORV use, and other recreation resource management will continue as recreation programs.
Recreation Program (1985:13)	Visual resources will continue to be evaluated as a part of activity and project planning, and areas not presently designated according to BLM VRM Classification will be designated in the future. These evaluations would consider the significance of a proposed project and the visual sensitivity of the affected area. Stipulations are to be attached, as appropriate, to assure compatibility of projects with management objectives for visual resources.
Recreation Program (1985:13)	On BLM-administered lands in Arizona where classes have not been established, the lands will be managed as VRM Class III.
Water Resources	None applicable
Wildlife and Special-status Species	
Wildlife Program (1985:13)	Wildlife objectives will continue to be analyzed in environmental assessments or resource activity plans to ensure the consideration of wildlife needs and values and to mitigate any adverse impacts to wildlife habitat.
Wildlife Program (1985:13)	Specification No.2: Before installing facilities, BLM will conduct a site evaluation for state-protected animals and will develop mitigation to project these species and their habitats. Such mitigation might include project relocation, redesign, or abandonment.
Wildlife Program (1985:13)	Specification No.3: BLM will initiate Section 7 consultation with the U.S. Fish and Wildlife Service on all actions that may affect federal listed threatened and endangered species or its critical habitat as required by the Endangered Species Act of 1973 as amended.
Wildlife Program (1985:13)	Specification No.6: Fences proposed in big game habitat will be designed to reduce adverse impacts to big game movement. BLM will consult with the Arizona Game and Fish Department on the design and location of new fences.
Wildlife Program (1985:13)	Specification No.8: As a general practice, new roads will not be bladed for use in fence construction. Vehicle will travel overland, or fences will be built by hand.
Wildlife/Fisheries (2009:10)	Desert Tortoise Habitat Management. Desert tortoise habitat management will be standardized throughout the MFP and RMP planning areas. This management will be consistent with *Desert Tortoise Habitat Management on Public Lands: a Rangewide Plan* (BLM, 1988) and *Strategy for Desert Tortoise Habitat Management on Public Lands in Arizona* (BLM, 1990) ["strategy"].

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Wildlife/Fisheries (2009:12)	Desert Tortoise Habitat Management. Comply fully with the Endangered Species Act of 1973, as amended, as it relates to tortoise population and habitat management on public lands. The Phoenix Field Office[1] will comply with Section 2 of the Endangered Species Act and BLM policy for managing habitat of candidate species to ensure that Sonoran population of the desert tortoise does not become threatened or endangered.
Wildlife/Fisheries (2009:12)	Desert Tortoise Habitat Management. Environmental decision documents for all actions occurring in desert tortoise habitat will address and include mitigation measures sufficient to offset, to the extent possible, any loss of tortoise habitat quantity or quality in category I, II, and III habitats.
Wildlife/Fisheries (2009:13)	BLM actions in desert tortoise habitats will be evaluated to assure that they do not encourage the proliferation or range expansion of predator populations.

[1] The "Phoenix Field Office" referenced in the 1985 RMP is now the "Phoenix District Office."

2.3.3 Applicant-committed Environmental Protection Measures Common to Each Alternative

Applicant-committed environmental protection measures are actions, practices, or design features that are part of the Proposed Action and all action alternatives and would be implemented by the proponent (Boulevard). Under all action alternatives, Boulevard would implement the applicant-committed environmental protection measures in Table 2.2 (as well as the management stipulations in Table 2.1) to minimize adverse impacts of the SSEP to sensitive environmental resources. These would be included as conditions of approval for any ROW approved by the BLM, and they would be binding in the event that the facility were transferred or operated by another entity.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

HAZARDOUS MATERIALS MANAGEMENT	
Hazardous material storage, handling, and use	All hazardous materials used during construction and operation would be stored on-site in storage tanks/vessels/containers that are specifically designed for the characteristics of the materials to be stored; as appropriate, the storage facilities would include the needed secondary containment in case of tank/vessel failure. All secondary containment would meet Occupational Safety and Health Administration (OSHA) requirements and would be sized to contain 110% of full tank/vessel volume. Secondary containment methods would include earthen bermed containment for the thermal energy storage (TES) system, concrete storage for other tanks, and polymer pallets for totes and drums. A variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials (e.g., Hazardous Material Business Plan). Plant personnel would be supplied with appropriate personal protective equipment (PPE) and would be properly trained in the use of PPE and the handling, use, and clean-up of hazardous materials used at the facility, as well as procedures to be followed in the event of a leak or spill. Adequate supplies of appropriate clean-up materials would be stored on-site.
Heat transfer fluid leak detection	Leak detection of HTF would be accomplished in a combination of ways. Small leaks, possible at ball joints or other connections, would be located based on daily inspection of the solar field. Those small leaks can then be corrected via repacking of joints or valves or by minor repairs if needed. The ability to isolate loops and sections of the field allows for quick repairs. In order to identify and react to larger leaks quickly, the SSEP would incorporate pressure sensing equipment and automatic controls that would allow for isolation of large areas of the field.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

Hazardous waste recycling	To the extent possible, both construction and operation-phase hazardous wastes would be recycled. The small quantities of hazardous waste that cannot be recycled will be accumulated for not more than 90 days in a designated area. Transport of the wastes and contaminated containers will be contracted to a qualified waste transporter, and the wastes will be taken, under manifest, to a permitted local landfill or treatment and disposal facility.
Thermal energy storage containment	To prevent a temperature hazard due to potential spills, the thermal storage area would be equipped with a berm of sufficient height to enable 110% storage capacity of one TES storage tank. Molten salt is not considered a hazardous material and containment is due to temperature hazard only. Salt freezes at ~450°F and quickly solidifies if a leak occurs.
Transformer containment	The generator step-up transformer would rest on a concrete pad with a perimeter berm designed to contain the transformer insulating oil in the event of a leak or spill.
HUMAN HEALTH AND SAFETY	
Fire protection	Fire protection systems are provided to limit personnel injury, property loss, and Project downtime resulting from a fire. The systems include a fire protection water system and portable fire extinguishers. Fire protection systems will be installed in operations and maintenance buildings and power block facilities.
Blasting safety	In the unlikely event that blasting is necessary, safeguards (e.g., blasting mats) would be employed when adjacent areas require protection. These measures would focus the explosive energy on the intended area to minimize material ejection from the blast.
Safe conductor installation	For public and existing line protection during wire installation, crossing structures would be erected adjacent to the existing transmission line and roadways or other structures requiring protection during conductor installation.
Hydrogen storage safety	Should Boulevard choose to use a hydrogen cooled generator, all standard industry practices would be employed to safeguard the system and minimize risks. Safeguards include leak detection, pressure/temperature monitoring, automatic generator shutdown, and fire detection/suppression systems.
Access restriction	In order to protect human health and safety, the entire site would be fenced appropriately to restrict public access during construction and operations.
BIOLOGICAL AND WATER RESOURCES	
Minimization of disturbance	To reduce the overall disturbance area of the SSEP, temporary construction laydown and parking areas would be provided in zones designated for long-term disturbance in the Project Area to the extent possible.
Clean-up and site reclamation	Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Approved enclosed refuse containers would be used throughout the SSEP. Refuse and trash would be removed from the sites and disposed of in an approved manner. Oils or chemicals would be hauled to a disposal facility authorized to accept such materials. Open burning of construction trash would not be acceptable. All post-construction ROWs would be restored, as required by the BLM. All practical means would be made to restore the land to its original natural drainage patterns. Because revegetation would be difficult in many areas of the SSEP because of low amounts of precipitation, all practicable measures would be taken to minimize disturbance during construction.
Grading minimization	Each solar pad would be graded with the intent of balancing the cut-and-fill as much as possible to minimize earth movement on the site. Drainage diversion channels and protective berms would also be developed with a balance of cut and fill earthwork.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

Reclamation of temporary disturbance	All temporarily disturbed areas would be reclaimed to as close to their pre-construction conditions as possible, as required by the BLM. Temporary access roads used during construction would also be regraded and restored to pre-existing function and grade. BLM-approved seed mixes would be applied to temporarily disturbed areas, as required. No fertilizer would be used during stabilization or rehabilitation activities unless authorized by the BLM. No vegetation would be restored or encouraged in the solar field because of the fire hazard. Vegetation in the land-treatment unit area would be controlled to prevent containment from being compromised. When construction of stormwater management structures is complete, contours would be carefully restored to the extent feasible.
Wading bird protection	The evaporation ponds would be designed with side slopes intended to discourage wading birds from accessing the ponds.
Wildlife protection	During nonworking hours, any open trench outside of fenced areas would be covered with wood or other material of sufficient strength to support wildlife (and people). Preconstruction wildlife surveys would include 100% surveys for burrowing owls. A qualified biologist would complete a pre-construction survey of the project area and a 200-meter (m) buffer (or as specified by the BLM AO) for burrowing owls according to the *Burrowing Owl Project Clearance Protocol* (Arizona Burrowing Owl Working Group [ABOWG] 2007). The biologist would possess a burrowing owl survey protocol training certificate issued by the AZGFD. Upon completion of the surveys, the contractor would contact the BLM to provide survey results. If any burrowing owl individuals are located during pre-construction surveys or during construction, the contractor would employ a biologist holding a permit from the USFWS to relocate burrowing owls from the Project Area, as appropriate, according to the *Burrowing Owl Project Clearance Protocol* (ABOWG 2007). The relocation site would be defined by BLM and relevant cooperating agencies. Pre-relocation surveys of the new burrow site(s) would be conducted to ensure its suitability as habitat and prevent significant resource conflicts. Preconstruction wildlife surveys would also include 100% clearance surveys for desert tortoise, kit fox (*Vulpes macrotis*), and badgers (*Taxidea taxus*). Boulevard would adhere to all funding requirements and stipulations of a memorandum of understanding (MOU) (once approved) regarding wildlife clearances and studies.
WATER/FLOODPLAIN/DRAINAGE	
Erosion control	Temporary drainage ditches and berms would be designed around construction work areas, soil stockpile areas, and excavation areas to minimize the amount of potential pollutant or sediment-laden surface water runoff.
Site Drainage and runoff control	The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls, along with detention time to reduce the peak off-site discharge and match pre-development conditions. The road berm would also be constructed to provide site protection from stormwater runoff during a 100-year return storm event. The toe of the western protective berm slope may be armored with soil cement cover and rip rap to provide for slope erosion protection during a heavy storm event.
AIR QUALITY	
Construction emissions	BMPs would be used to assure that construction of the project results in PM_{10} less than 70 tons per year (tpy), which is the threshold for minor sources in the nonattainment area. The final construction schedule and construction management would reflect this commitment.
Dust suppression	An approved dust suppression coating would be used on the dirt roadways in and around the solar field. The coating would not be applied to areas of the field between roads.
Road maintenance	Road maintenance would be performed as needed. Paved roads would be swept, sealed, and/or overlaid as needed. Grading and drainage would be maintained for gravel and earthen roads. Dust palliatives would be applied, as required, to limit fugitive dust.
VISUAL RESOURCES	
Lighting system	Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives and would be shielded and oriented to focus illumination on the desired areas and minimize additional nighttime illumination in the site vicinity.

2.3.4 Potential Mitigation Measures

All above applicant-committed environmental protection measures, management stipulations, and LORS would be incorporated into the ROD as terms and conditions of the ROW grant. Potential mitigation measures are discussed following the impact analysis for each resource or use (see Chapter 4) and could also be selected in the ROD as terms and conditions of the grant. Potential mitigation includes additional means, measures, or practices not incorporated into the Proposed Action or alternatives that would further reduce or eliminate impacts. These mitigation measures are specific to resource sections, and thus are considered following the impact analyses in Chapter 4. These mitigation measures will be considered as possible terms and conditions of the ROD, if and when an action alternative is selected. The effectiveness of potential mitigation measures is disclosed in the subsequent discussion of residual impacts, which are those impacts that would remain after the implementation of all potential mitigation measures.

The ROD will summarize the requirements for mitigation monitoring and enforcement to ensure compliance with the decision, per BLM NEPA Handbook H-1790-1 and 40 CFR § 1505.2(c).

2.4 No Action Alternative

Under the No Action alternative, Boulevard's ROW application to develop the SSEP under the Proposed Action, Alternative A: Reduced Water Use, Sub-alternative A1: Photovoltaic, or Alternative B: Reduced Footprint would not be approved. No ROW would be granted. The SSEP would not be developed, and existing land uses in the Project Area would continue. The No Action alternative forms the baseline against which the potential impacts of the Proposed Action and the other action alternatives are compared. Thus, it includes current actions and activities in the Project Area. No additional actions are assumed to occur in the absence of approval of any of the action alternatives.

Under the No Action alternative, the following ongoing actions and activities would be assumed to continue, and are accounted for in the analysis of impacts in Chapter 4:

- Livestock grazing in the Project Area would continue in two allotments. Authorized grazing would continue on approximately 2,649 acres of the Beloat grazing allotment in the Project Area, or approximately 78 AUMs. Approximately 1,053 acres of the Arnold allotment would continue to be used for ephemeral grazing. Ephemeral allotments are not grazed annually; they are only grazed when infrequent (ephemeral) precipitation allows the production of adequate forage. The Arnold allotment is grazed approximately 6 out of 10 years, and approximately 44 AUMs per year.
- Limited dispersed recreation across the Project Area would continue. The Project Area is currently used infrequently by hikers, mountain bikers, backcountry drivers, hunters, and birders. OHV use is limited to 13.1 miles of existing routes in the Project Area.

In order to compare the socioeconomic and environmental consequences of developing the Project Area versus not developing it, this EIS assumes that other ROWs would not be approved in the Project Area in the near future under the No Action alternative. However, selection of the No Action alternative would not preclude the approval of other ROWs for energy development or other projects in the future.

Several test wells have been drilled in the Project Area to assess the potential water supply for the SSEP. Under the No Action alternative, these wells would be filled, capped, and abandoned, and any associated site disturbance would be reclaimed.

2.5 Proposed Action

2.5.1 Introduction

The Proposed Action for the SSEP would consist of two independent, concentrated solar electric generating facilities with expected net electrical outputs of approximately 125 MW and 250 MW. This output represents the power that would be supplied to the utility grid after a 10% loss for use on-site for plant operations.

Parabolic trough solar thermal technology would be used to produce electrical power using steam turbine generators fed from solar steam generators. The solar steam generators receive heated HTF from solar thermal equipment comprising arrays of parabolic mirrors that collect energy from the sun. Each plant would use natural gas firing to supplement electrical output, auxiliary boilers to reduce startup time, and HTF freeze protection heaters to maintain the HTF at a minimum of 100 degrees Fahrenheit (°F) (see Figures 2.2 and 2.3).

Each plant would be designed to allow the use of TES, which would consist of a two-tank, molten salt system designed to provide approximately three hours of storage. The purpose of the TES would be to increase daily hours of operation, shift energy production into peak periods, and make up production during periods of extended cloud cover. The ultimate construction and use of TES would depend on the direct preference of customers (i.e., those entities purchasing the power from the SSEP), which could change over the life of the SSEP.

The Proposed Action would use a wet-cooling tower for power plant cooling. Water for cooling tower make-up, process water make-up, and other industrial uses (such as mirror washing) would be supplied from on-site groundwater wells, which would also be used to supply water for employees' use (e.g., drinking water, showers, sinks, and toilets). A package water treatment system would be used to treat the water to meet potable standards. A sanitary septic system and on-site leach field would be used to dispose of sanitary wastewater.

Based on publicly available sources (LAZARD 2008, Solar Energy Industries Association [SEIA] 2010, WorleyParsons Group 2008), the estimated capital cost of the facility under the Proposed Action would be between $1.7 and $2.4 billion (see Table 2.15). This cost includes capitalized interest costs during construction, as well as operation and maintenance costs and fuel prices .

2.5.1.1 FACILITY LOCATIONS AND COMPONENTS

The Project Area (see Map 1, Figure 2.1) is located at the west end of the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills and the Town of Buckeye, Arizona. Under the Proposed Action, the SSEP's facilities would be located almost entirely on BLM-administered lands and would encompass approximately 3,620 acres in western Maricopa County, Arizona. Approximately 1.5 miles of road improvements are proposed on private and state lands at the western edge of the Project Area, as well as approximately 0.5 mile of gen-tie line on private land.

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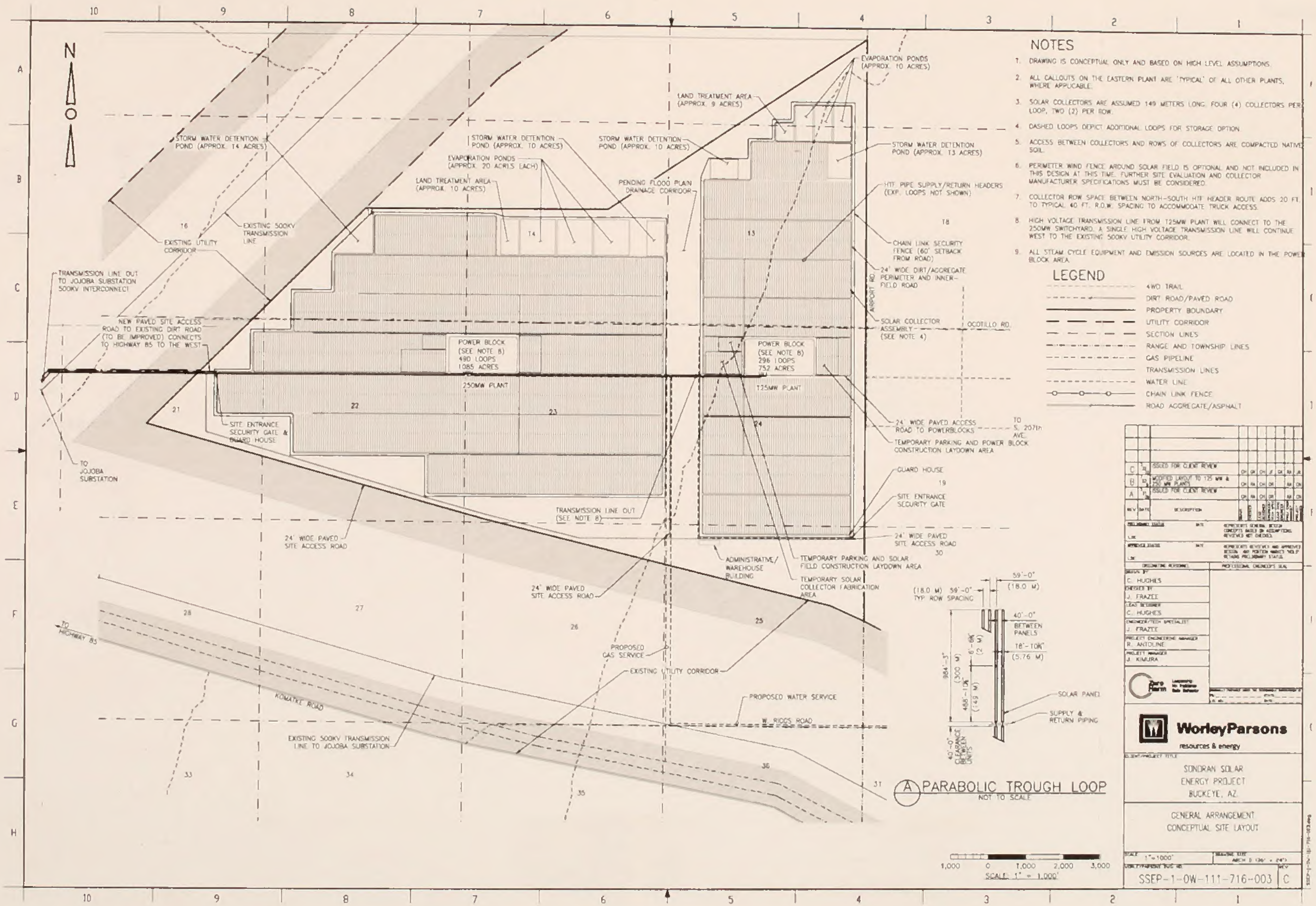

Figure 2.1 Conceptual site layout.

Under the Proposed Action, the SSEP would consist of three major types of facilities: a well field, linear facilities, and power plants (the main project footprint). Each of these components is shown on Map 2 and Figure 2.1, and explained in detail in the following sections. The major components of these three facility types are outlined below. The amount of temporary (construction) and permanent (life of project) disturbance required for these facility components is described in detail in Section 2.12.

A well field would be developed to supply water for the SSEP during the construction and operation phases. The well field would be located approximately 1.2 miles east of the power plant area (see Map 2), and would include the following components:

- Four wells with on-site pumping facilities
- A booster pump station
- Supporting linear facilities including service roads, buried pipelines, and electrical service

A number of linear facilities would be developed externally from the main power plant footprint. These linear facilities are shown on Map 2, and would include the following:

- Access roads
- A generation tie (gen-tie) line to carry electricity to the Jojoba Switchyard
- A natural gas pipeline
- Water pipelines

The power plant facilities would be located in approximately 3,313 graded acres in the primary project footprint. The power plant facility footprint would be fenced and would function largely as a single facility. Specific components of the power plant facilities would include the following:

- Power block areas
- Administration buildings and local warehouses
- Solar collector field arrangements
- Evaporation ponds
- Land-treatment unit
- On-site transmission facilities
- On-site gas pipeline facilities
- Drainage collection and discharge facilities

Under the Proposed Action, power blocks (Figure 2.2; see Figure 2.1) and arrays of solar troughs (see grey areas surrounding the power blocks in Figure 2.1) would occupy approximately 2,300 acres of the approximately 3,620-acre site. Additionally, evaporation ponds, access roads, administration buildings, other support facilities, a land-treatment unit, drainage control, and open areas would occupy approximately 1,300 acres, for a total disturbance of approximately 3,600 acres (see Figure 2.1 and Map 2). The power blocks would include these major components:

- Solar steam generator heat exchangers
- Steam turbine-generators and condensers
- Wet-cooling towers
- Natural gas-fired auxiliary boilers
- HTF surge volume tanks
- Firewater pumps and pump houses with associated diesel fuel tanks
- Emergency diesel generators
- Two treated water storage tanks
- Demineralized water storage tanks
- Natural gas co-fired boilers/HTF heaters
- TES systems
- Ancillary equipment
- Control room buildings

Solar field size was maximized to the extent possible within the main project footprint and available land. The solar field was slightly oversized to allow for the collection of additional solar energy for the TES system. A conceptual engineering drawing of the main power plant footprint is shown on Figure 2.1. A simplified layout of the 125-MW power block is shown in Figure 2.2.

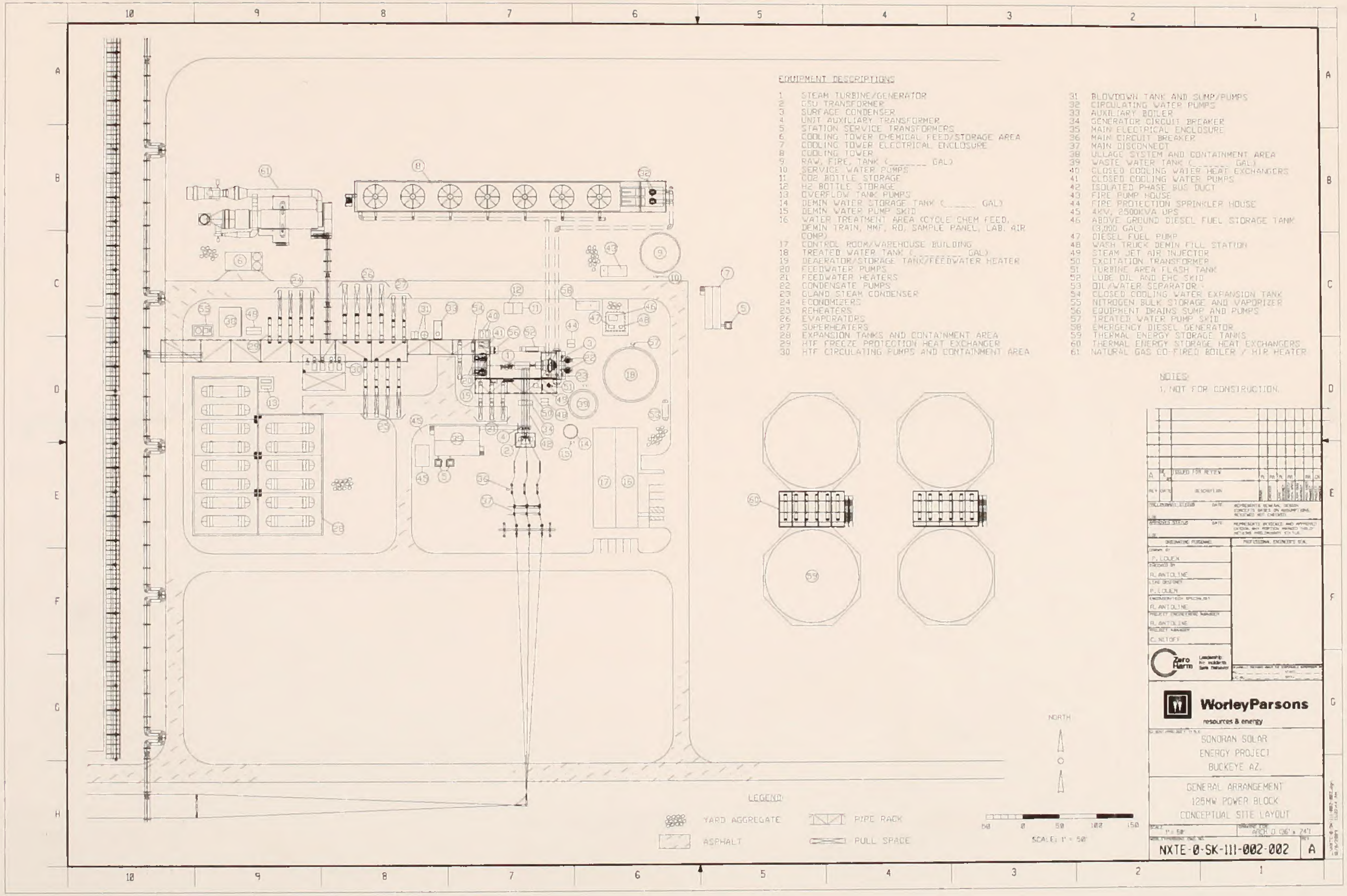

Figure 2.2 Generalized power block arrangement (125-MW example).

2.5.1.2 PROCESS DESCRIPTION

The SSEP would generate electricity using the Rankine-with-reheat thermodynamic cycle, which is used primarily to convert heat into work. The heat is supplied externally to a closed loop, which usually uses water as the working fluid. This cycle generates about 80% of all electric power used throughout the world, including virtually all solar thermal, biomass, coal, and nuclear power plants.

Figure 2.3 illustrates the SSEP's solar-generation process. The SSEP would operate between 3,200 and 3,800 hours per year, depending on local solar insolation and level of natural gas co-firing.

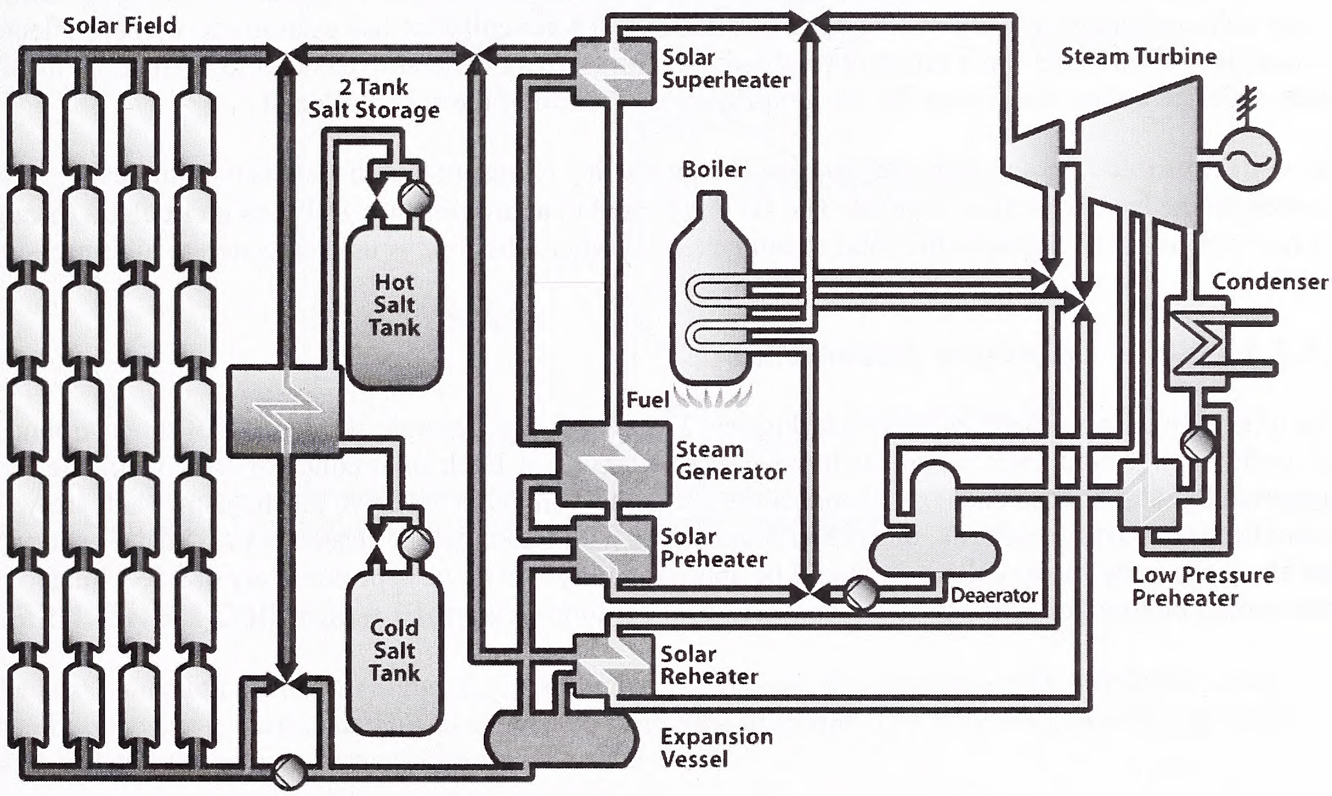

Figure 2.3 Solar-generation process illustration.

There are four processes in the Rankine cycle:

Process 1: Water is pumped from low to high pressure. To increase cycle efficiency, steam extracted from the steam turbine generator is used to preheat the water prior to entering the solar steam generating system.

Process 2: The high pressure water enters the solar steam generator system where it is heated by the HTF to become superheated steam.

Process 3: The steam expands through the various sections of the steam turbine, which causes the turbine blades to rotate around an axle that is connected to an electrical generator. The rotational energy is converted into electricity by the generator.

Process 4: The steam enters the surface condenser where it is cooled at a constant low pressure to become water. The water returns to Process 1.

As the HTF is circulated from the solar steam generator through the solar field, it absorbs solar energy and provides a high temperature (740°F) energy source for the Rankine cycle. The gas co-firing would supplement additional heat to obtain desired unit output during times of low solar insolation.

2.5.2 Proposed Facilities and Infrastructure

2.5.2.1 SOLAR FIELD

The collector field would consist of approximately 2,300 acres of multiple single-axis-tracking parabolic-trough solar collectors aligned on a north-south axis. Each solar collector has a parabolic-shaped reflector (mirror) that focuses the sun's direct normal radiation on the heat collection element located at the focal point of the parabola. See Figure 2.4 for a typical cross section of the solar collector.

The collectors track the sun from east to west during the day to ensure that the sun is continuously focused on the heat collection element. The HTF is heated to approximately 740°F as it circulates through the heat collection elements to the solar steam generator where the fluid is used to generate high-pressure steam.

2.5.2.1.1 Solar Collection Assemblies

The solar collection assemblies, shown in Figures 2.4 and 2.5, are dynamic structures that rotate around the north-south axis to track the sun as it moves through the sky. Each solar collector array would be supported by structures (stands) that connect the parabolic troughs to the drive mechanism. Each array would be supported by multiple, individual foundations with a foundation located approximately every 50 feet along the array. Solar collectors would be approximately 149 m, or approximately 489 feet long; there would be four collectors per loop and two rows per loop.

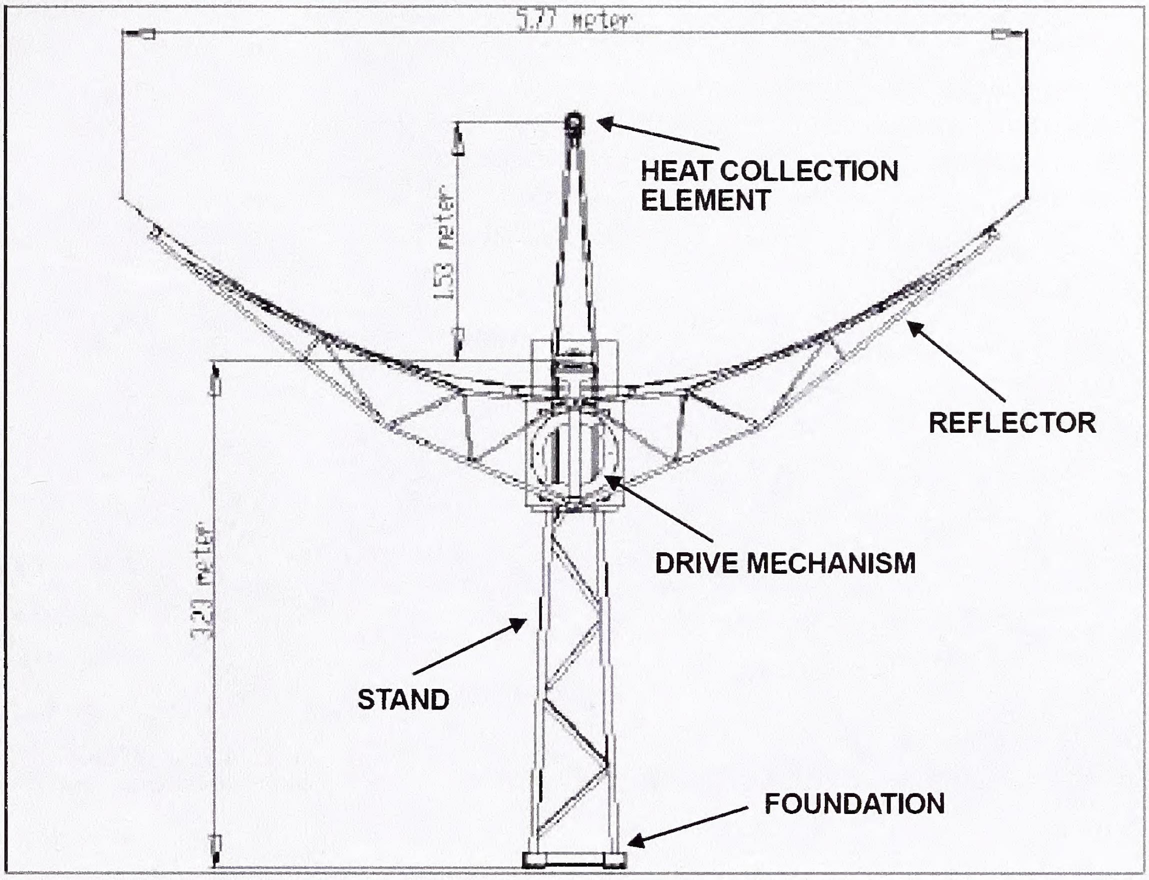

Figure 2.4 Typical parabolic trough solar collector cross section.

2.5.2.1.2 Heat Collection Elements

The heat collection elements (Figure 2.5; see Figure 2.4) consist of a steel tube with a selective (heat absorbing) coating, surrounded by an evacuated glass tube insulator. The HTF circulates though these tubes and gathers heat as it travels through the solar field.

2.5.2.1.3 Mirrors

The parabolic mirrors (Figure 2.5) that would be used to gather solar energy would be low-iron glass mirrors, which are known to be reliable components that show no long-term degradation in reflective quality.

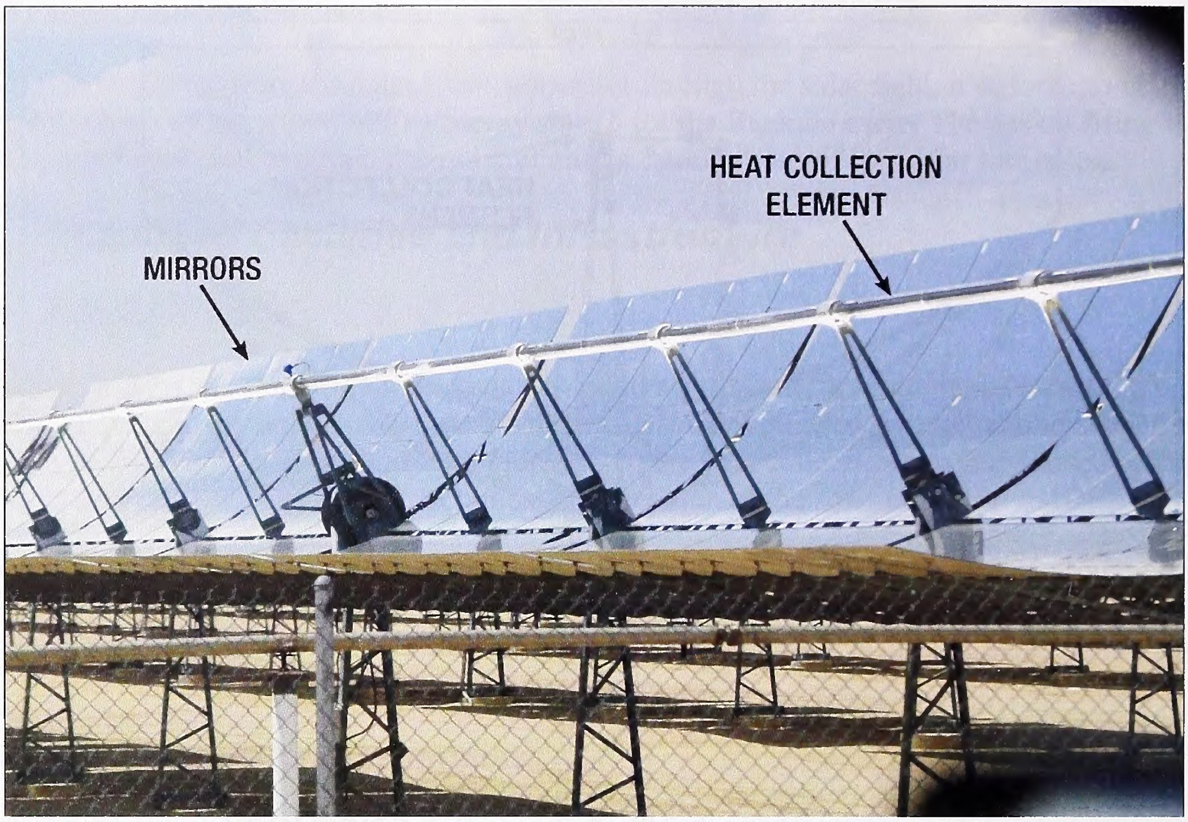

Figure 2.5 Typical parabolic trough.

2.5.2.2 POWER BLOCKS

Power blocks would be centrally located in each solar field (see Figure 2.1 and Map 2). Under the Proposed Action, they would occupy approximately 40 acres in the 250-MW plant area and 40 acres in the 125-MW plant area. Figure 2.6 shows an example of a solar facility power block.

2.5.2.2.1 Solar Steam Generator System

The solar steam generator system design circulates HTF through tubes and boils water to produce steam. The system includes heat exchangers for preheating the condensate, superheating the steam, and reheating steam, in addition to the boiler vessels.

2.5.2.2.2 Heat Transfer Fluid Specific Systems

The HTF consists of diphenyl ether (73.5%) and biphenyl (26.5%). The HTF freezes (becomes a solid) at temperatures below 54°F. To maintain the fluid above freezing temperature, a gas-fired direct-contact HTF heater would be used to keep the HTF at or above 100°F whenever the facility is offline. Expansion tanks are required to accommodate the volumetric change that occurs when heating the HTF to the operating temperature. Nitrogen would be used to blanket the headspace of the tanks. The nitrogen purge prevents oxidation or contamination of the HTF by reducing its exposure to atmospheric air. A system to remove contaminants caused by thermal degradation of the HTF would also be incorporated. Supply and return piping is routed to allow for balanced flow through all the heat collection elements.

2.5.2.2.3 Major Electrical Systems and Equipment

Roughly 10% of the steam turbine generator output would be used on-site for plant auxiliary loads such as motors, heaters, control systems, and general facility loads, including lighting and heating, ventilation, and air conditioning. Some of the power needed for on-site uses would be converted from alternating current (AC) to direct current (DC) for power plant control systems and emergency backup systems. Power would be generated by the steam turbine generator (size and generation voltage is dependent on the final generator selection) and stepped up by a fan-cooled generator step-up transformer.

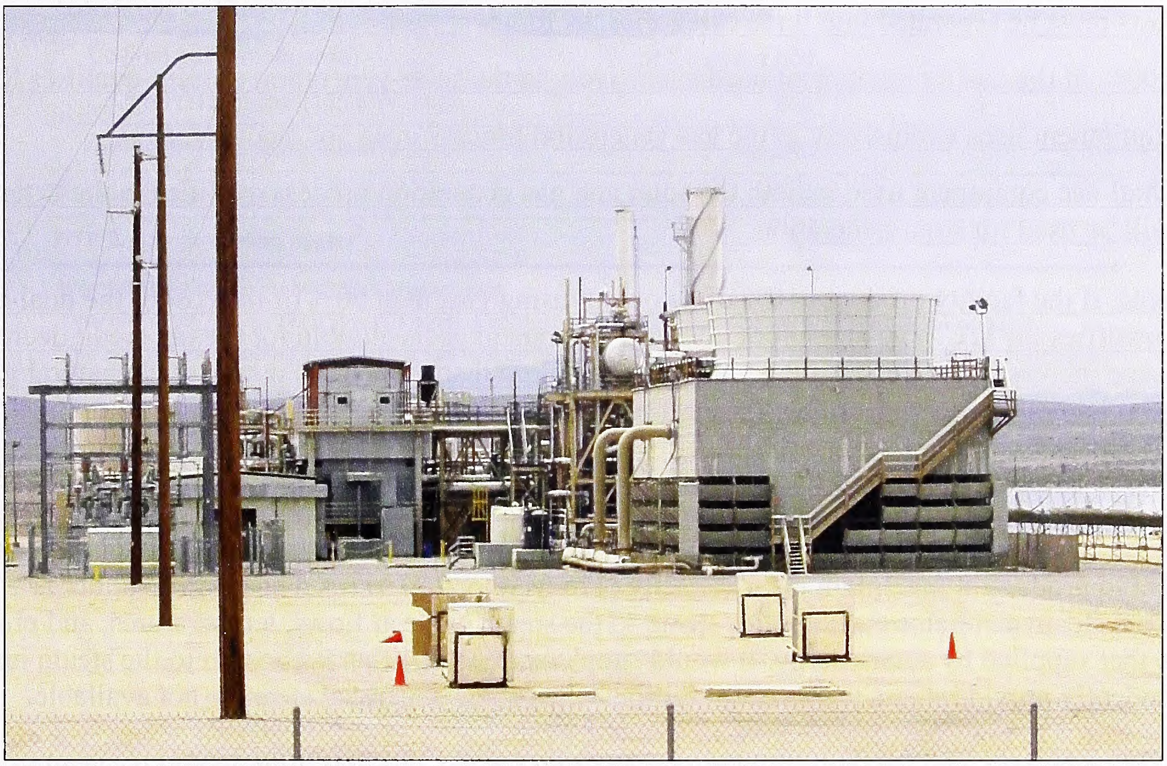

Figure 2.6 Example of power block.

2.5.2.2.4 Administration Building, Control Room, and Warehouse Locations

A control building would be located in each power block. The SSEP would include a single common administration building and warehouse located in the southwest corner of the 125-MW solar field. The design and construction of the administration building and warehouse would be consistent with all applicable state and local building codes. Other plant site "buildings" would include the water treatment building as well as a number of pre-engineered enclosures for mechanical and electrical equipment. Building columns would be supported on reinforced concrete mat foundations or individual spread footings, and the structures would rest on reinforced concrete slabs. The total square footage of the various project buildings and pre-engineered enclosures (e.g., control rooms, administration building, warehouse, electrical equipment enclosures, fire pumps, and diesel generators) would be approximately 38,000 square feet for the 250-MW unit and 22,000 square feet for the 125-MW unit.

2.5.2.2.5 Natural Gas Co-firing

One of two co-firing methods—co-fired boilers or HTF process heaters—would be used to augment solar heating and allow the plant to operate at its full load if the solar resource varies or is insufficient to reach the desired plant output. Natural gas co-firing power production would be limited to up to 25% of annual total electrical production. The method selected would depend on customer preference and contract, costs,

and operational needs. For the purposes of analysis, it is assumed that 25% of the plants' annual power production would come from co-firing, although this total would likely be far less. Use of supplemental generation, if required, would likely occur during the early morning and late evening when solar resources are insufficient to produce maximum output.

The natural gas usage limitation (25% of total plant output) is driven by the Internal Revenue Service regulations related to the Investment Tax Credit (ITC) available to solar projects. This ITC equates to 30% of the eligible solar equipment costs. In general, a solar project that does not have any (0%) gas usage can qualify 100% of its solar equipment for the ITC. If a solar project has gas burn capability, the project costs must be separated into three categories, as follows:

- 100% of the cost of equipment used exclusively in the solar-generation process qualifies for ITC.
- Equipment used exclusively in the gas generation process does not qualify for ITC.
- Dual-use equipment used in both the solar and gas generation process qualifies to the extent it will be used for solar generation.

For example, if the facility produces 10% of its output using gas, then 90% of the cost of the dual-use property qualifies for ITC. The amount of dual-use equipment costs eligible for the tax credit decreases as the gas usage increases. However, if the unit generates more than 25% of its output using natural gas, the facility is no longer considered eligible for the ITC.

Natural Gas Co-firing Boilers Method

In this method, natural gas-fired boilers would provide steam to the steam turbine when solar energy is insufficient to produce at maximum plant capacity (125 MW or 250 MW). The co-fired boiler is a conventional steam generator that supplies steam to the steam cycle at flows, temperatures, and pressures similar to that supplied by solar energy. It would supplement solar-generated steam to the steam turbine, or independently provide steam to the steam turbine when solar-generated steam is not available.

Three co-firing boilers, one for the 125-MW unit and two for the 250-MW unit, would be sized to independently produce the maximum load and would also be able to operate simultaneously to produce a full load even if the solar resource varies slightly because of cloud cover. The co-firing boiler would comply with all the regulations under the SSEP's air permit. It would also comply with all local county regulations for the stack height. Although the final stack height has not been determined, this EIS has assumed a stack height of 150 feet for the purposes of air quality and visual analysis.

Heat Transfer Fluid Heaters Method

In this method, a series of natural gas-fired heaters would be used to heat the HTF to 740°F if the solar field is unable to perform this function. The hot HTF would then be used to generate steam in the same manner as the solar-generated steam operation. As with the boiler method, the HTF heater method could also be used to supplement solar-generated power by incrementally heating the HTF to full load, operating temperatures when the incoming solar radiation is insufficient to reach the desired plant output. The HTF heater system would also be designed to reach full load even if no solar heat was available.

Summary of Gas-fired Equipment

Table 2.3 provides a summary of the natural gas-fired equipment for each facility.

Table 2.3 Natural Gas-fired Equipment

Equipment	Burner Specification Capacity[3] (million British thermal units per hour (MMBtu/hr)	Number of Units
Natural gas co-firing[2]	depends on method, below[1]	
Co-fired boiler (both units)[1]	1,600	3
Co-fired HTF heater (125-MW unit)[1]	600	3
Co-fired HTF heater (250-MW unit)[1]	1,200	3
Auxiliary boiler[2]	30	2
HTF freeze protection heater[2]	30	2

Note: MMBtu = million metric British thermal units.

[1]Only one of the two methods (co-fired boiler or co-fired HTF heater) would be used for natural gas co-firing.

[2]The total natural gas-fired equipment would include an auxiliary boiler, a HTF Freeze protection heater, and one of the co-firing methods.

[3] Burner specification capacity is greater than the fuel design capacity due to process factors.

Under the Proposed Action, the maximum, annual, natural gas usage is expected to be 3,900 million standard cubic feet per year for a maximum of 3,982,000 million metric British thermal units (MMBtu) per year. Table 2.4 shows the typical composition of the natural gas used to fuel the SSEP auxiliary boilers.

Table 2.4 Typical Gas Composition

Component	Molar Percent (%)
Methane, CH_4	94.90
Ethane, C_2H_6	2.54
Propane, C_3H_8	0.34
Butane, C_4H_{10}	0.0685
Pentane C_5H_{12}	0.0164
Hexane, C_6H_{12}	0.0326
Nitrogen, N_2	1.53
CO_2	0.51
Total	**100.00**
Higher heating value (Btu/standard cubic feet)	1,021

2.5.2.2.6 Thermal Energy Storage

TES would be designed as a component of the generation plant. Depending on requirements of the customer, TES may be installed and used to supplement electrical output during reduced solar activity (i.e., intermittent cloud cover). A TES system would 1) permit longer, daily plant run time, 2) support shifting of the morning solar resource to electrical generation during evening hours when system demand is higher, and 3) reduce effects of local cloud cover transients. The TES system would be designed to store the heat equivalent of rated plant capacity for up to three hours. The TES would be an indirect

storage system using molten salt as the energy storage material. A "two tank" system is the most proven TES technology and consists primarily of the following components:

- Hot salt storage tanks
- Cold salt storage tanks
- Salt-to-HTF heat exchangers
- Molten salt transfer pumps

During the "storage" process, the TES system transfers molten salt from the cold salt storage tanks (approximately 550°F) through the heat exchanger to the paired hot salt storage tanks (approximately 720°F). During this transfer process, the cold molten salt gains energy from the HTF in the heat exchanger and reaches a temperature of 720°F. The process used to release the stored energy is the reverse of the "storage" process, whereby thermal energy is transferred from the molten salt to the HTF. The molten salt would be a blend of approximately 60% sodium nitrate and 40% potassium nitrate. The thermal storage area would be equipped with a berm of sufficient height to enable 110% storage capacity of one TES storage tank. Molten salt is not considered a hazardous material and would quickly solidify if a leak occurred. The berm is designed to minimize the temperature hazard only.

2.5.2.3 EVAPORATION PONDS (NORTH SIDE OF SOLAR FIELDS)

Evaporation ponds are used to evaporate different types of wastewater from the plant's cooling operations. The 125-MW unit would have three approximately 10-acre, double-lined evaporation ponds (30 acres total), and the 250-MW unit would have three approximately 20-acre, double-lined evaporation ponds (60 acres total). Multiple ponds are planned to allow plant operations to continue in the event that a pond must be taken out of service for some reason (e.g., scheduled maintenance). Each pond would have enough surface area so that the evaporation rate exceeds the cooling tower blowdown rate at maximum design conditions and annual average conditions. The ponds would not require clean-out for the life of the project. At the end of the project, the ponds would be back-filled. The ponds would be located below site grade. Dirt gathered from digging the ponds would be used to berm the ponds to prevent unwanted inflows and add additional overflow protection.

2.5.2.4 LAND-TREATMENT UNIT (NEXT TO THE EVAPORATION PONDS)

The SSEP would include a land-treatment unit that would treat soils impacted by incidental spills and leaks of HTF. The unit would be designed and permitted as a Class II Land-treatment Unit in accordance with all Arizona state and federal requirements. Under the Proposed Action, the land-treatment unit for the 125-MW unit would cover approximately 5 acres. The 250-MW unit would have an approximately 10-acre land-treatment unit. Each land-treatment unit would be constructed with a prepared base consisting of 2 feet of compacted, low permeability, lime-treated material and surrounded on all sides by a minimum 2-foot-high compacted earthen berm with slopes of approximately 3:1 (horizontal: vertical).

2.5.2.5 ON-SITE SWITCHYARD AND TRANSMISSION FACILITIES

2.5.2.5.1 On-site Switchyard

The SSEP steam turbine generators would electrically connect to a 500-kV on-site switchyard. The steam turbine generators generate electricity at 13.8 kV, but this voltage would be increased in the switchyard to 500 kV via a generator circuit breaker and a generator step-up transformer. The generator step-up transformer would rest on a concrete pad with a perimeter curb designed to contain the transformer's insulating oil in the event of a leak or spill.

The plant site switchyard is currently expected to be located near the 250-MW power block, as previously shown in Figures 2.1 and 2.2 and would require an overhead steel-reinforced, aluminum conductor-unit tie line for the connection to each unit's generator step-up transformer. The switchyard would consist of

500-kV switchyard circuit breakers with 500-kV disconnect switches on each side of the breaker for breaker maintenance. The final location of the common switchyard would be determined by the final design.

Final design of the plant switchgear has not yet been completed; however, preliminary designs do not include the use of sulfur hexafluoride (SF_6) at the plant switchyard. In the event that it is used, all industry standard leak prevention measures would be employed.

2.5.2.5.2 Interconnection to the Jojoba 500-kV Switchyard

To deliver the energy produced by the SSEP to the grid, the SSEP would interconnect into the Jojoba Switchyard. The SSEP interconnection to the Jojoba Switchyard would require the addition and modification of equipment in the switchyard. All work would be performed in accordance with the applicable electric utility standards, and performed by the substation operating agent. No switchyard footprint expansion would be required as a result of SSEP interconnection.

2.5.2.5.3 Generation Tie Line

The following description of the gen-tie line was provided in the draft EIS. The generated electrical power from the SSEP switchyard would be transmitted through a gen-tie line for delivery at the Jojoba Switchyard. The gen-tie would be routed in a generally southwestern direction and would use an existing utility corridor. The gen-tie line would be constructed for the nominal operating voltage of the regional transmission system, which is 500 kV. Each circuit would be supported by lattice structures more than 140 feet tall (Figure 2.7) spaced at approximately 1,200- to 1,600-foot intervals. Final heights would be determined during the detailed design process. Between 25 and 35 structures would be required, depending on the final tower spacing interval. This number, along with tangent, angle, dead-end, pull-off structure, and hardware design would be determined during final engineering of the gen-tie and interconnection.

Since the publication of the draft EIS in April 2010, minor changes have been made to the design and alignment of the gen-tie line. The revised alignment allows crossing points under existing transmission lines without any modifications to the existing lines. The gen-tie line would be placed as close to an existing transmission structure as possible so that clearance between the lines and from the lower line to the ground is maximized. An approximately 100-foot-tall H-frame tower structure would be used due to its cost effectiveness (Figure 2.7) and its lower height when compared to the original 140-foot-tall lattice structure. This new H-frame structure would allow for the low crossings under existing lines while maintaining safe clearances. Three-pole towers would also be used at turning points in the alignment (Figure 2.8). Slight modification to the placement of the access road and spur road would also be required. These changes would affect all action alternatives equally and are further discussed in Chapter 4, Section 4.1.3. A supplemental EIS was not prepared because this revised gen-tie would result in impacts of the same nature and approximate extent (and to the same resources) as those considered in the draft EIS, and would not result in any unique site-specific impacts not considered in the draft EIS. Under the revised gen-tie alignment, 33.52 acres of surface disturbance would be required west of the solar field for roads and other gen-tie construction. This compares to a total of 33.25 acres under the original alignment discussed in the draft EIS, which is a difference of 0.27 acre or less than a 1% increase in surface disturbance. With a total surface disturbance of 3,620 acres for the Proposed Action, this amounts to an overall increase in surface disturbance of approximately 0.01%.

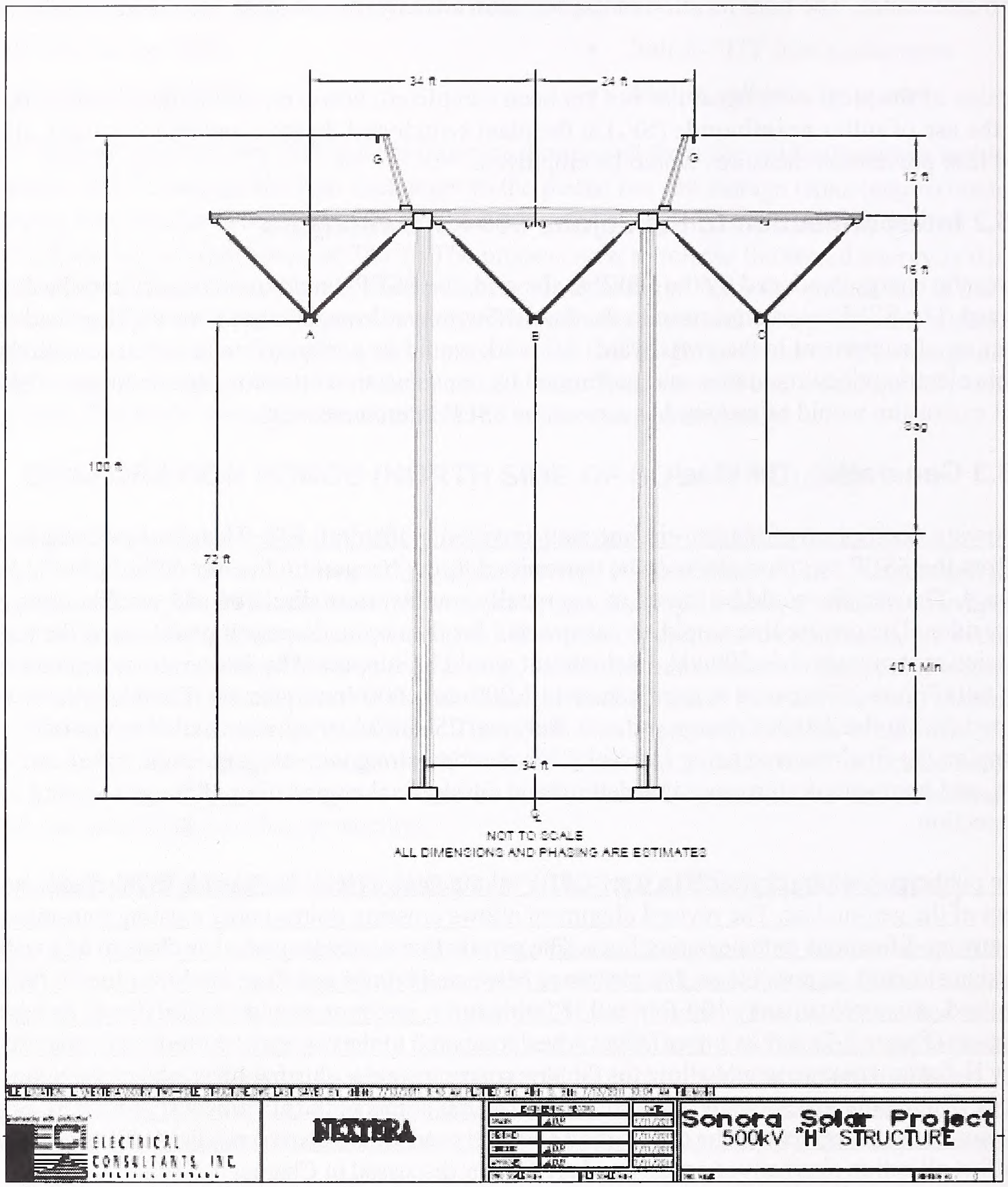

Figure 2.7 Typical H-frame structure.

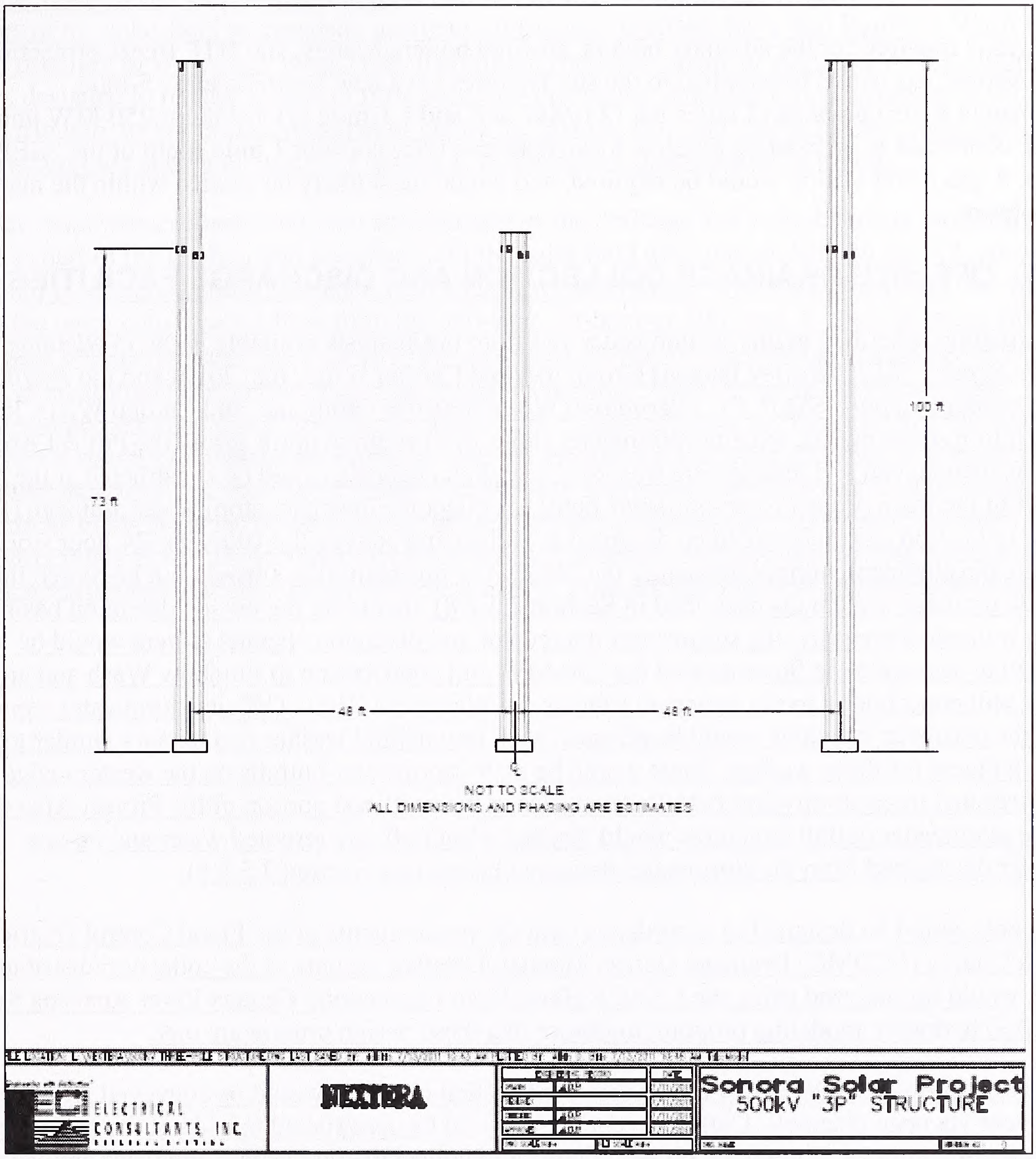

Figure 2.8 Typical three-pole structure.

2.5.2.6 NATURAL GAS PIPELINE

Natural gas is required for the auxiliary boilers, co-fired boilers/heaters, and HTF freeze protection heaters. Natural gas would be supplied to the site facilities via a new approximately 5-mile, approximately 8-inch pipeline (4 miles for 125-MW unit and a 1-mile extension for 250-MW unit) that would be connected to an existing pipeline located in the utility corridor 1 mile south of the SSEP facilities. A gas meter station would be required, and would most likely be located within the main power plant footprint.

2.5.2.7 OFF-SITE DRAINAGE COLLECTION AND DISCHARGE FACILITIES

The information described in this section is derived from the analysis available in the *Preliminary Master Drainage Report, SSEP* (Worley Parsons Group Inc. and Cardno WRG, Inc. 2010) and the *Preliminary Master Drainage Report, SSEP, PV Alternative* (WorleyParsons Group Inc. and Cardno WRG, Inc. 2011). During storm events, existing stormwater flows from south to north across the Project Area and collects in channelized and meandering washes. Collection channels would be constructed at the southern perimeter of the main project footprint (solar field) to collect the upstream stormwater drainage (Figure 2.9). The collection channels would be designed to collect and convey the 100-year, 24-hour storm event around the development without impacting the SSEP. The upstream flows would not be routed through the on-site drainage system (as described in Section 2.5.2.8), including the on-site detention basins. To maintain watershed integrity, the stormwater interceptor and diversion channel system would be configured to segregate the flows around the 250-MW unit contributing to Rainbow Wash and around the 125-MW unit contributing to the unnamed tributary to Waterman Wash. Off-site stormwater conveyed through the perimeter channels would be released back into natural washes in a manner similar to historic drainage patterns for those washes. There would be eight stormwater outfalls on the western edge of the Project Area and three stormwater outfalls to washes in the northeast portion of the Project Area (Map 2). The three stormwater outfall structures would discharge both off-site rerouted water and on-site stormwater discharged from the stormwater detention basins (see Section 2.5.2.8).

The channels would be designed in accordance with the requirements of the Flood Control District of Maricopa County (FCDMC) Drainage Design Manual. Detailed designs of the collection/distribution channels would be analyzed using the USACE Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic modeling program to ensure that these design criteria are met.

The upstream drainage collected by the diversion/collection channels would be conveyed around the development via open channels. Collection channels would be constructed outside of the perimeter fence at the southern perimeter of the main project footprint to collect the upstream stormwater drainage. The channels would have a 50- to 150-foot top width, with the larger widths being at the downstream end. The channel depths would range from 3 to 6 feet. The channel sides would have gentle slopes (6 feet horizontally to 1 foot vertically), and the channel walls would not be greater than 6 feet high, except in short sections where the outside bank of a curve would reach up to 8 feet (i.e., it would be super-elevated). The channel substrate would be either earthen or riprap. There would be riprap lining on sections of the channels where the velocity is anticipated to be erosive. This would typically be where natural washes are flowing into the channel or at the bends in the channel. Channel cross section, channel slope, channel width, and channel lining would be designed to control flow, velocity, and erosion/sediment transport. The channel bends would be rounded as much as practicable, given available land constraints. In addition, the channel banks would be super-elevated per standard drainage engineering practice. A channel on the northwest side of the Project Area would serve to distribute the flow back into the natural washes at a rate equal to or less than the existing condition for each wash.

Stormwater outfalls and their associated distribution channels would be constructed at the north/northwest perimeters of the solar field to distribute upstream stormwater drainage back into Rainbow Wash and the unnamed tributary to Waterman Wash. The distribution channels would be equipped with multiple outlet structures designed to release upstream flow back into the natural drainage ways (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the historic flow rate to the fullest extent possible. These structures are shown on Map 2, Figure 2.1, and depicted conceptually in Figure 2.9.

All surface disturbances associated with construction of the drainage and with diversion facilities are included as part of the grading and preparation of the solar field described in Section 2.5.3.3. All access roads would be designed and constructed with engineered stormwater crossings or culverts (see Map 2), allowing the more conservative flow from the 100-year, 24-hour or 100-year, 6-hour upstream storm event to pass without flooding the roadway. The east-west portion of the well field access road would be designed as an at-grade gravel roadway. The drainage crossings would be designed as low-water crossings (dipped crossings) to allow the low flow in the washes to cross the roadway in a manner similar to the existing conditions. The larger crossings may be designed with concrete inverts to prevent scour and maintain access after a significant event. The invert of these concrete dipped crossings would be designed to be at the same elevation (plus or minus 6 inches) as the natural flow line of the wash to allow for the conveyance of low flows across the access road. Maintenance of this access road may be necessary following a significant rainfall event to remove sediment from the surface of the dipped crossings.

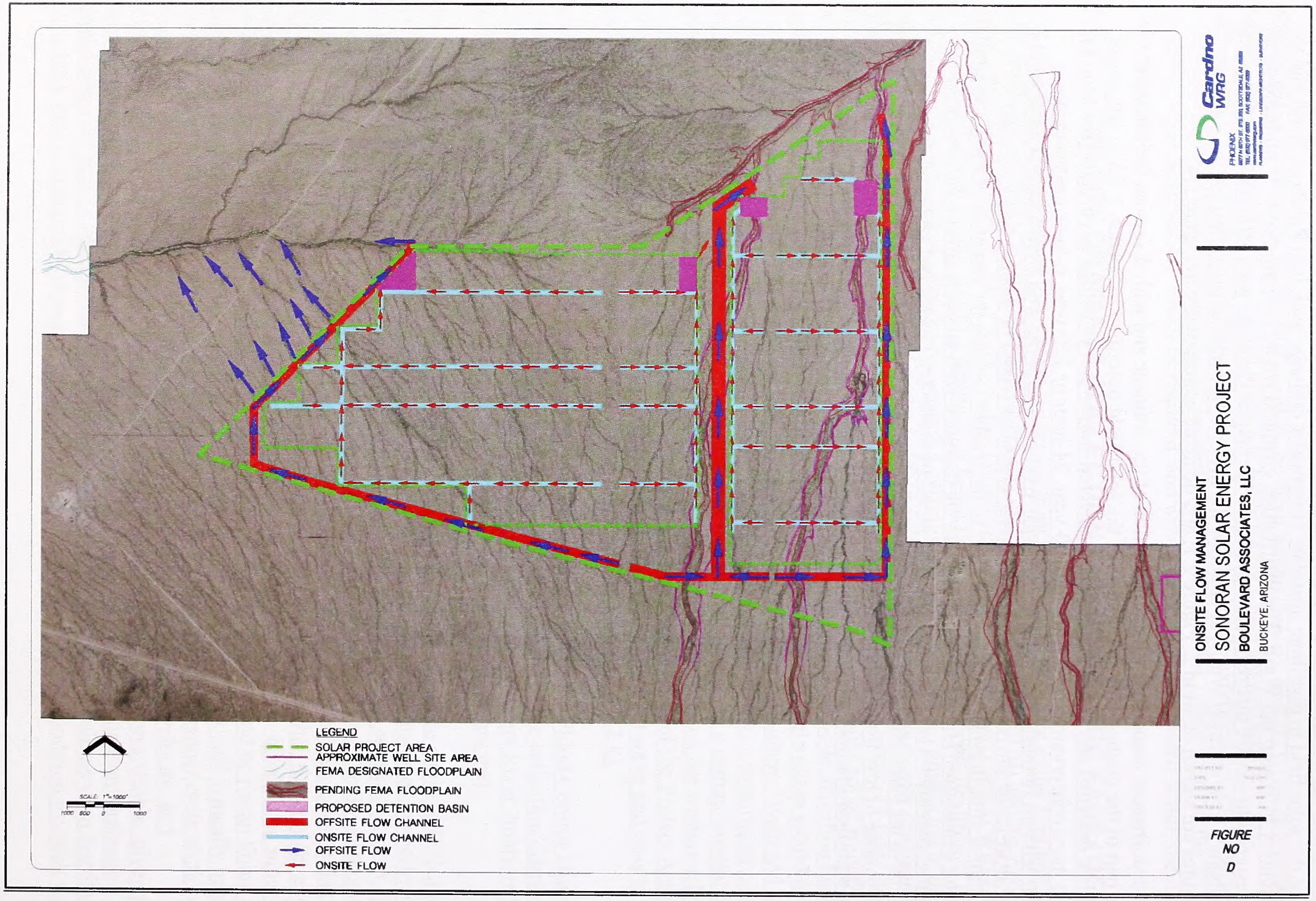

Figure 2.9 Conceptual post-construction drainage flow.
Note: the location and configuration of the basins in this figure are conceptual. Figure 2.1 shows a scaled configuration of the stormwater detention basins.

2.5.2.8 ON-SITE DRAINAGE AND DISCHARGE FACILITIES

2.5.2.8.1 Stormwater Detention Basins

The overall drainage concept for the Proposed Action is shown in Figure 2.9 and Maps 2 and 7. On-site stormwater runoff within the solar field would sheet flow into redirected smaller drainage channels, aligned east to west. The solar field interior access roads would act as drainage channels (see Figure 2.9). The earthen interior access roads would be compacted and stabilized to minimize erosion. Velocities within the drainage channels would also be minimized by designing the channel shape, slope, and material to match the allowable velocity. The unlined sections of the channel would be designed such that the longitudinal slope would be flat enough and the flow depth would be shallow enough to maintain a manageable non-erosive velocity. In areas where the velocity could not be maintained at a non-erosive level, a channel lining would be designed commensurate to the resulting velocity. The smaller channels would divert flows to larger drainage channels, aligned north to south adjacent to the plant perimeter road. The larger channels would divert flows into detention basins. The basins would be designed per the requirements of the FCDMC. Areas of the solar field that are in the Rainbow Wash watershed would be drained to a stormwater detention basin in the northwest corner of the Project Area. The area of the solar field currently in the Waterman Wash watershed would drain to the north and east. A small portion of the 250-MW block would drain to a stormwater detention basin in the northeast corner of that block. Runoff from the 125-MW block would drain to two stormwater detention basins on the north end of the Project Area.

Fences and other infrastructure would be designed to be consistent with the drainage plan to reduce the possibility of damage associated with large hydrologic events. Each detention basin would have an emergency spillway at the crest of the pond berm. In the unlikely event of a 100-year storm event or blockage at the detention pond outfall, the detention basin would release water through the emergency spillway. Fences near stormwater detention basins would include an adequately sized opening in the bottom of the fence to allow the emergency spillway flow to pass under the fence unimpeded.

2.5.2.8.2 Stormwater Outfalls

The stormwater detention basins would attenuate the post-development 100-year, 24-hour storm event runoff from each solar field, and they would discharge into the natural drainage system downstream (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the pre-developed 100-year, 24-hour storm event flow rate, to the fullest extent possible. The detention basins would discharge within 36 hours, while allowing sediments and on-site pollutants to settle out. The detention basins would be equipped with engineered outfall structures that would be designed to release the historic 100-year, 24-hour storm event at rates that would eliminate any significant negative impact to the downstream drainage system and properties. Outlet sizes would range from a 10 × 4–foot box culvert to a 36-inch reinforced concrete pipes. Peak outflow discharges would range from 46 to 840 cubic feet per second (cfs).

The detention basins would also have emergency spillways to discharge runoff generated from major rainfall events in excess of the 100-year, 24-hour storm. Emergency spillways would discharge into the proposed perimeter distribution channels, diverting the excessive flow away from the SSEP. Riprap outlet protection at the stormwater outfalls and basin emergency spillways would dissipate the flows and protect these outlets from scour of the soil. The outfall structures would be designed per the requirements of the FCDMC.

As with upstream (off-site) drainage, all on-site drainage would be released to the historic drainage ways (Rainbow Wash and unnamed tributary to Waterman Wash) at the downstream end of the SSEP's main project footprint (see Figure 2.1; Maps 2 and 7). The upstream diversion/collection channels, downstream distribution channels, and on-site stormwater storage system outlet structures would be designed and constructed to maintain historic drainage patterns and flow rates.

2.5.2.9 WELL FIELD (EAST OF THE SOLAR FIELDS)

Under the Proposed Action, as many as four high-capacity groundwater production wells would be needed to meet the water supply requirements of the SSEP at full build-out. This estimate is based on reported yields from wells east of the property (approximately 1,000 to 1,600 gallons per minute [gpm]) and an estimated total water demand of 2,305–3,003 afy, or 1,428 to 1,860 gpm, for a 375-MW project in an average year. Using a conservative assumption of 500 to 1,000 gpm per well, as many as three wells would be needed on a continuous basis, with a fourth well as a backup. A typical water duty cycle for a production well field (percentage of wells operating at a given time) ranges from 60% to 80%; therefore, this configuration (75%) falls within that range. These wells would draw groundwater from an aquifer in the Rainbow Valley Sub-basin of the Phoenix Active Management Area (AMA). More information about groundwater use can be found in Chapter 4's water resources section.

The well field design is still in the conceptual stage. Based on the expected design and operational needs, the following components are expected (see Map 2), and have been assumed for the purposes of analysis:

- Four production well sites of approximately 200 feet by 200 feet. Each area would include a well house, pumping facility, parking area, and ancillary facilities. Although the entire area may not be needed to house permanent facilities, it has been considered a permanent impact for analysis because it may be needed for safe equipment use during well maintenance.
- Linear connection facilities, including water pipelines and access roads. Buried water pipelines connecting each well site to a potential pumping booster station in the southwest well area (which is assumed to be 300 feet by 300 feet). Each pipeline is expected to share a 65-foot ROW (temporary disturbance) with a 24-foot-wide road (permanent disturbance) and electrical service line (estimated permanent disturbance up to 25 feet). A service road and pipeline (sharing a ROW) would be improved south from the well field to Riggs Road. These service road improvements may continue on to the plant area (see Map 2). If upgraded, the improvements to the service road would be coordinated with the organization having jurisdiction (Maricopa County or the Town of Buckeye depending on the portion of the road) and would be completed to applicable standards.
- Electrical service for the well field would be installed running from an existing 69-kV transmission line along Riggs Road to the well field. The transmission line would occupy the same 65-foot temporary disturbance buffer as the access road and pipeline. Because this service has not been fully defined, a conservative permanent disturbance ROW of 50 feet is assumed for the road and electrical service poles and access in all analysis.

The Proposed Action would use groundwater pumped from the Project Area and legally secured through a GIU Permit. Boulevard has already obtained a GIU permit and would obtain all applicable well permits from the ADWR. Because the Project Area is more than 3 miles outside of any city, town, or private water company's service area, and because no other water source or withdrawal authority is available pursuant to the requirements in A.R.S. § 45-515, the GIU permit was issued at this site for up to 50 years. As part of the GIU permit review process, ADWR required that Boulevard demonstrate the availability of groundwater for the requested permit timeframe.

Pursuant to ADWR's well spacing and well impact rules and as part of the well permit review process, ADWR required Boulevard to demonstrate that the proposed groundwater withdrawals would not cause unreasonable, increasing damage to surrounding land or other water users. Such damage could include declining groundwater levels in neighboring wells and subsidence of land due to groundwater pumping. Boulevard demonstrated that groundwater pumping to supply the SSEP would not cause water levels in neighboring wells to decline more than 10 feet over five years.

2.5.2.10 ROADS AND ACCESS

Regional access to the facility would be from SR-85 via an access road from the west. This roadway would improve on the existing Jojoba Switchyard access road (controlled by Arizona Public Service [APS]) and use the road currently servicing the Wesco mining operations as much as practicable. The junction of this road and SR-85 would be improved, and a new stop sign would be posted at the new westbound approach to the intersection of SR-85 northbound ramps and the SSEP access road (also known as Riggs Road) (Figure 2.10). This all-weather road would have one lane in each direction, with approximately a 24-foot paved width. The road would be sized to handle all potential vehicle traffic during construction. Access would be shared with APS/Salt River Project (SRP) and the Wesco mine. The primary access road running from SR-85 would cross several washes and would require culverts and crossings of undetermined width. For that reason, a temporary and permanent disturbance width of 50 feet is assumed for the primary access road. All other access roads (new or improved gen-tie, well field, or gas line access roads) are assumed to require a temporary disturbance of 50 feet and a permanent disturbance of 24 feet. Riggs Road east of the solar field would be used only for emergency purposes and to sporadically access the well field, and it would not be authorized as a secondary access point.

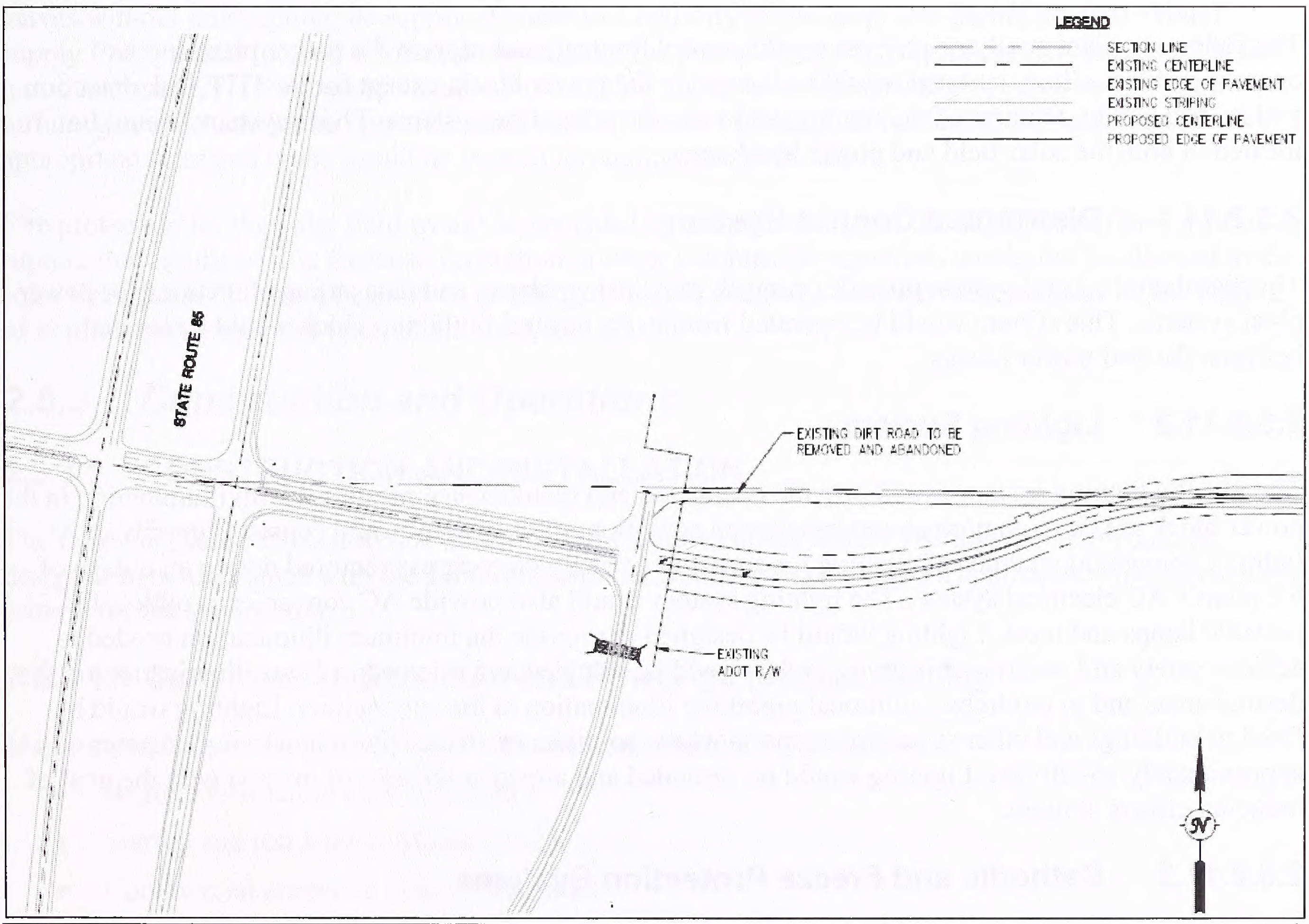

Figure 2.10 State Route 85 SSEP (Riggs Road) road intersection improvement.

Only a small portion of the overall plant site would be paved, primarily the site access road and portions of each power block (paved parking lot and roads encircling the steam turbine generator and solar steam generator). The remaining portions of the power block would be gravel surfaced. The solar field would remain unpaved and without a gravel surface in order to prevent rock damage to mirrors from mirror wash vehicle traffic; an approved dust suppression coating would be used on the dirt roadways in and

around the solar field. Potential dust coatings include magnesium chloride (MgCl) and commercially available polymers.

The entire site would be fenced appropriately to restrict public access during construction and operations. Chain-link security fencing would be installed around the site perimeter (approximately 10 miles), switchyard, and other areas requiring controlled access. The security fence would be approximately 8 feet tall, topped with approximately 1 foot of barbed wire (three strands) mounted on 45° extension arms. The fence posts would be set in concrete.

Controlled access gates would be located at the entrances to the facility. Site gates would be swing-or-rolling type access gates. Access through the main gate would require an electronic swipe card to prevent unaccompanied visitors from accessing the facility. All facility personnel, contractors, agency personnel, and visitors would be logged in and out of the facility at the main office during normal business hours. Visitors and non-SSEP employees (except agency personnel on government business) would be allowed entry only with approval from a staff member at the facility.

2.5.2.11 PLANT AUXILIARY SYSTEMS

The following plant auxiliary systems would control, protect, and support the power plant and its operation. All auxiliary systems would be located in the power block, except for the HTF leak detection system and certain features of the lighting and cathodic protection systems. Those systems would be located in both the solar field and power block areas.

2.5.2.11.1 Distributed Control System

The distributed control system provides control, monitoring, alarm, and data storage functions for power plant systems. This system would be operated from in the control building, which would be located between the two power blocks.

2.5.2.11.2 Lighting System

The SSEP's lighting system would provide operations and maintenance personnel with illumination in the power block area in both normal and emergency conditions. The system would consist primarily of AC lighting, but would include DC lighting for activities or emergency egress required during an outage of the plant's AC electrical system. The lighting system would also provide AC convenience outlets for portable lamps and tools. Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives, and it would be shielded and oriented to focus illumination on the desired areas and to minimize additional nighttime illumination in the site vicinity. Lighting would be fixed to buildings and other structural supports where possible, or affixed to ground mounted poles of approximately 15–20 feet. Lighting would be shrouded and aimed at the area of interest with the goal of reducing effects at night.

2.5.2.11.3 Cathodic and Freeze Protection Systems

Cathodic protection systems protect against electrochemical corrosion of underground metal piping and structures. Underground piping metal structures would have cathodic protection, as necessary, based on soil conditions. Depending on soil conditions, either a passive or impressed current system may be used.

Freeze protection systems (heat tracing) would be employed to protect small water and condensate piping systems that cannot be easily drained. Also, due to the high freezing temperature of the solar field's HTF (54°F), a direct-fired HTF freeze-protection heater would protect the system during the night hours and colder months (see Table 2.3).

2.5.2.12 FIRE PROTECTION

Fire protection systems would be provided to limit personnel injury, property loss, and SSEP downtime resulting from a fire. The systems would include a fire protection water system and portable fire extinguishers. Additional emergency response would be provided externally by local municipalities if required. The proponent would develop an escape fire plan in consultation with the BLM. This plan would be approved by the BLM and become a part of the authorization for the solar plant facility.

Each power plant's fire protection water system would be supplied from a dedicated 360,000-gallon portion of the raw water storage tank located on the plant site and would contain a minimum capacity to supply two hours of full flow runtime. One electric- and one diesel-fueled backup firewater pump, each with a capacity of 3,000 gpm, would deliver water to the fire protection water-piping network for each plant. A smaller electric motor-driven jockey pump would maintain pressure in the piping network. If the jockey pump is unable to maintain a set operating pressure in the piping network, the diesel fire pump starts automatically.

The piping network would be configured in a loop so that a piping failure can be isolated with shutoff valves without interrupting the supply of water to a majority of the loop. The piping network would supply fire hydrants located at intervals throughout the power plant site, a sprinkler deluge system at each unit transformer, HTF expansion tank and circulating pump area, and sprinkler systems at the steam turbine generator and in the operations and administration buildings. Portable fire extinguishers of appropriate sizes and types would be located throughout the plant site.

Fire protection for the solar field would be provided by zoned isolation of the HTF lines in the event of a rupture that results in fire. Because vegetation or other combustible materials would not be allowed in the solar field, the HTF would be allowed to extinguish itself naturally, because the remainder of the field is of nonflammable material (aluminum, steel, and glass).

2.5.3 Construction and Operations

2.5.3.1 CONSTRUCTION AND INSTALLATION

The following subsections describe civil/structural features of the SSEP. The power plant would be designed in conformance with the 2006 International Building Code and with applicable wind and seismic criteria for the site location.

2.5.3.1.1 Construction Schedule and Power-generation Facility

Major milestones of the planned SSEP construction schedule are as follows:

- Begin construction Unit 1: Month 1
- Startup and test Unit 1: Month 21–28
- Commercial operation Unit 1: Month 28
- Begin construction Unit 2: Month 7
- Startup and test Unit 2: Month 38–39
- Commercial operation Unit 2: Month 41

SSEP construction is expected to occur over 39 months. Start-up and testing would occur over approximately 2 months, for a total of 41 months of work on the site. The current schedule is staggered to take advantage of mobilization efficiencies. However, depending on negotiations with potential

customers, the timing of the second unit's construction schedule could be shifted. Construction would require an average of approximately 870 employees over the entire 39-month construction period, with labor requirements peaking at approximately 1,500 workers in month 24. The construction workforce would consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. The socioeconomics section in the Chapter 4 contains more information regarding construction workforce by skill over the entire construction period.

Construction would be phased so that the 125-MW unit would be operational as soon as approximately one year before the separate 250-MW unit becomes operational. Construction of the 125-MW unit is expected to take approximately 25–28 months, whereas the 250-MW unit is expected to take approximately 30 to 32 months. Table 2.5 depicts a proposed construction plan for the SSEP. This plan is preliminary and could shift during project construction based on generation requirements, contractual milestones with off-takers, and emission thresholds from grading.

Table 2.5 Sonoran Solar Energy Project Construction Plan

Activity	Unit 1	Unit 2
Mobilization	Month 1	Month 7
Construct well field and water supply pipelines	Month 1	n/a
Delineate and mark the boundaries of the construction zone	Month 1	Month 7
Stabilize construction entrance/exit and roadway; install tire wash	Month 1	Month 7
Establish parking and staging areas for vehicle and equipment storage; maintenance	Month 1	Month 7
Establish laydown area(s) for materials storage/staging	Month 1	Month 7
Establish concrete washout area	Month 1	Month 7
Clear and grub; strip topsoil	Months 1–2	Months 7–8
Install certified weed-free fiber rolls or silt fence at the base of slopes adjacent to delineated sensitive areas (i.e., wetlands), if any.	Months 1–2	Months 7–8
Construct stormwater infiltration/evaporation areas	Months 4–8	Months 11-14
Assemble and erect parabolic troughs	Months 6–18	Months 12–26
Construct power block	Months 7–25	Months 13–38
Construct reinforced concrete foundations	Months 5–11	Months 12–18
Trench gas line corridor	Months 15–19	n/a
Construct gen-tie line	Months 24–28	n/a
Construct administration/warehouse building	Months 24–25	n/a
Commissioning and testing	Months 25–28	Months 37–41

Temporary construction laydown and parking areas would be provided in the Project Area. With the exception of linear facilities (gas/water lines and gen-tie line), construction laydown would remain in the overall facility footprint. Gas and water line laydown areas would be within the ROWs for their respective pipelines. The gen-tie would have separate laydown areas, pad construction areas, and pulling areas.

Construction power would be provided by the local distribution system and routed to the site along wood poles. Due to the size of the plant site, the solar field laydown area would be relocated periodically as the solar field is built out. The construction sequence for power plant construction includes the following:

Site Preparation: This includes detailed construction surveys, mobilization of construction staff, grading, and preparation of drainage features. Grading for the solar field, power block, and rerouted washes would be completed during the first nine months of the construction schedule. Site preparation would include the removal (and salvage, as required under the Arizona Native Plant Law) of all vegetation from the site for the duration of the SSEP. Vegetation removal would be maintained through the application of approved herbicides and where needed, mechanical removal.

Site grading would require a maximum cut depth of approximately 8 feet and an average cut depth of approximately 4 feet. These values are for site grading only and do not include depth for trenches or site drainage. Site grading is estimated to require approximately 4,238,535 cubic yards (CY) of cut and 1,071,536 CY of fill. Therefore, there would be excess cut of approximately 3,166,999 CY. Excess cut on-site would be used in the solar field, eliminating the need to export fill from the Project Area. Fill would be compacted as necessary, and appropriate dust abatement measures would be taken. A detailed breakdown of the site's expected cut and fill volumes is provided below:

- Solar fields: 3,808,165 CY cut, 1,003,535 CY fill
- Diversion channels: 430,370 CY cut
- Detention ponds: 68,001 CY fill

These values are preliminary and may vary with final design.

Foundations: This includes excavations for cooling tower, footings for the solar field, and ancillary foundations in the power block.

Major Equipment Installation: Once the foundations are complete, the larger equipment would be installed. The solar field components would be assembled in an on-site erection facility and installed on foundations. Equipment and materials would be delivered to the SSEP by truck; large components (e.g., the solar thermoelectric generator [STG]) would be brought by rail to the nearest rail siding and then trucked to the site.

Best Operating Practices: With the major equipment in place, the remaining fieldwork would be piping, electrical, and smaller component installations.

Testing and Commissioning: Testing of subsystems would be done as they are completed. Major equipment would be tested once all supporting subsystems are installed and tested.

2.5.3.2 CONSTRUCTION AND OPERATIONS TRANSPORTATION NEEDS

The SSEP would not provide on-site residential areas for construction workers. Construction workers would most likely commute from the Phoenix and Gila Bend areas. At the expected construction peak, 1,200 to 1,500 workers would be needed during a 16- to 18-month period. A more typical number for nonpeak construction workers would be 600 workers.

At the peak of construction, approximately 1,000 vehicles carrying construction workers would be driving to and from the Project Area each day during the typical AM and PM peak hours. This number of vehicles assumes that due to the larger than normal commute times expected from population centers and the current price of fuel, some construction workers would carpool. In addition, although most of the workers would be expected to arrive and depart during peak hours, specialty workers would be expected to arrive on-site during nonpeak hours. Approximately 30 to 60 trucks per day would be required to deliver various materials and construction equipment during nonpeak periods.

With construction complete, the operation of the SSEP would require approximately 82 permanent employees working in four shifts. The day shift would consist of approximately 10 office employees with operators/maintenance technicians working 12-hour shifts of 18 operators per shift. Thus, it is estimated that traffic generated by the plant's employees would consist of 46 AM and PM peak hour trips. The typical employee traffic is not expected to occur until after the peak period of construction is completed.

Table 2.6 shows the expected trip generation for the new SSEP facility during the peak of construction and after buildout.

Table 2.6 Weekday Project Site Generated Trips

Time Period	Phase I: Construction Peak 2012	Phase II: Operation 2014
AM peak hour, inbound (vph)	1,000	28
AM peak hour, outbound (vph)	0	18
Total AM Peak	**1,000**	**46**
PM peak hour, inbound (vph)	0	18
PM peak hour, outbound (vph)	1,000	28
Total PM Peak	**1,000**	**46**

Note: Vph = vehicles per hour.

2.5.3.3 CIVIL WORKS CONSTRUCTION SEQUENCE

The construction sequence for civil works includes the following general steps:

Site Disturbance: Once all areas are appropriately staked and signed and access to the site has been established, grading activities would occur over an extensive portion of site. Grading would commence with rough grading activities, including grubbing, clearing, moisture conditioning, bulk grading, and initial compaction. The first ground-disturbing activities to take place would be the initial clearing and grading to prepare the site for stormwater drainage, construction, and equipment foundation pads. Temporary drainage ditches and berms would also be designed around construction work areas, soil stockpile areas, and excavation areas to minimize the amount of potential pollutant or sediment-laden surface water runoff. The estimated temporary and permanent disturbance for the SSEP is detailed in Section 2.5.2.

Site Grading: The solar pad grading of the power plant footprint would have an average slope of 1% to 3% on the north-south direction. Each solar pad would be graded with the intent of balancing the cut-and-fill as much as possible to minimize earth movement on the site. Drainage diversion channels and protective berms would also be developed with a balance of cut and fill earthwork. Site grading would require a maximum cut depth of approximately 8 feet and an average of approximately 4 feet. These values are for site grading only, and do not include depth for trenches or site drainage.

Site Drainage: The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls, along with detention time to reduce the peak off-site discharge to pre-development conditions. The detention ponds would be designed to drain within 36 hours. Sediment would be monitored and removed from the ponds as needed. Stormwater flows entering the detention basins would be from within the solar field only.

On-site drainage would be collected in channels and conveyed to the outer reaches of the solar field where they would flow down to the stormwater detention basins. All off-site stormwater would be conveyed around the solar field via diversion channels. All channels and detention ponds would be sized

to pass the 100-year return storm event. The road berm would also be constructed to provide site protection from stormwater runoff during a 100-year return storm event. The toe of the western protective berm slope may be armored with soil cement cover and riprap to provide for slope erosion protection during a heavy storm event.

Internal Road System: A primary access road would be constructed to the power block areas. This road would run from an existing road terminating at the Jojoba Switchyard, and would require both new construction and improvement of existing road (see Map 2). This road would be 24 feet wide and paved with approximately 3,000 tons of imported asphalt concrete material per mile. Auxiliary roads would be 24 feet wide and use compacted native materials or gravel surface.

2.5.3.3.1 Generator Tie Line

The gen-tie line would be constructed with crews working continuously along the ROW, with construction of the entire gen-tie line requiring a peak workforce of approximately 34 workers. Gen-tie line construction would include the following activities:

- Preparation of marshalling yards
- Access road and spur road construction
- Clearing and grading of pole sites
- Foundation preparation and installation of poles
- Conductor installation
- Clean-up and site reclamation

Various construction activities would occur during the construction process, with several construction crews operating simultaneously at different locations. The following subsections describe in more detail the construction activities associated with the SSEP gen-tie line.

Marshalling Yards: Construction staging/laydown and parking areas are proposed in the Project Area. Construction materials such as concrete, wire and cable, fuels, and small tools and consumables would be delivered to the staging/laydown areas by truck. Mobile trailers or similar suitable facilities (e.g., modular offices) would be used for construction offices in the staging/laydown areas.

Road Work: The construction, operation, and maintenance of the proposed gen-tie line would require that heavy vehicles access structure sites along the ROW. The SSEP proposes to use the newly constructed site access road, Komatke Road, and Riggs Road for all construction, operation, and maintenance activities associated with the gen-tie line. If required, new spur roads approximately 14 feet wide and averaging 75 feet in length, would be constructed from the access roads to the structure sites. Each spur road would lead to a construction pad for a pole structure.

Pole Pads: At each site, a work area would be required for the structure footing location, structure assembly, and the necessary crane maneuvers. The work area would be cleared of vegetation only to the extent necessary, and the construction pad would be leveled to facilitate the safe operation of equipment, such as construction cranes.

Pole Erection: Transmission line pole structure foundations would be excavated with power drilling equipment. A vehicle-mounted power auger or backhoe would be used to excavate for the structure foundation. Although not expected, in some instances blasting could be necessary because of specific geologic conditions.

Installation of new pole structures to support the 500-kV bundled circuit would begin with the excavation of foundations approximately 4 feet in diameter and 12–20 feet in depth (depending on soil conditions). A truck-mounted auger, backhoe, or similar equipment would typically be used for excavation of this type. Once the foundation holes have been cleared, the poles with preassembled insulators, hardware, and stringing sheaves would be lifted into position and inserted into the foundation holes. Native soil, gravel, or concrete would be poured in to backfill the hole and create the support for the structure. The selection of backfill material would be determined during detailed design based on site-specific soil properties. In areas where loose sandy soils are encountered, culverts placed vertically in the open hole(s) may be temporarily or permanently required to keep the sides of the open hole from collapsing. Erecting each pole structure would take approximately two to three hours.

Conductor Installation: Typical conductor stringing activities are illustrated in Figure 2.11. Crossing structures would be erected adjacent to the existing transmission line and roadways or other structures requiring protection during conductor installation. Crossing structures would prevent ground wire, conductors, or equipment from falling on an obstacle, and would be removed following the completion of conductor installation. Equipment for erecting the crossing structures would be the same as the equipment discussed above for transmission pole installation. Crossing structures may not be required for small roads or other areas where suitable safety measures such as barriers, flagmen, or other traffic controls could be used.

Pilot lines would be pulled (strung) from structure to structure and threaded through the stringing sheaves at each structure. This phase of work may be accomplished through the use of helicopters to minimize or otherwise eliminate the need to traverse the ROW along the ground from structure to structure. Following the pilot lines, a larger diameter, stronger line would be attached to the conductors to pull them onto the structures. This process would be repeated until the ground wire or conductor is pulled through all sheaves.

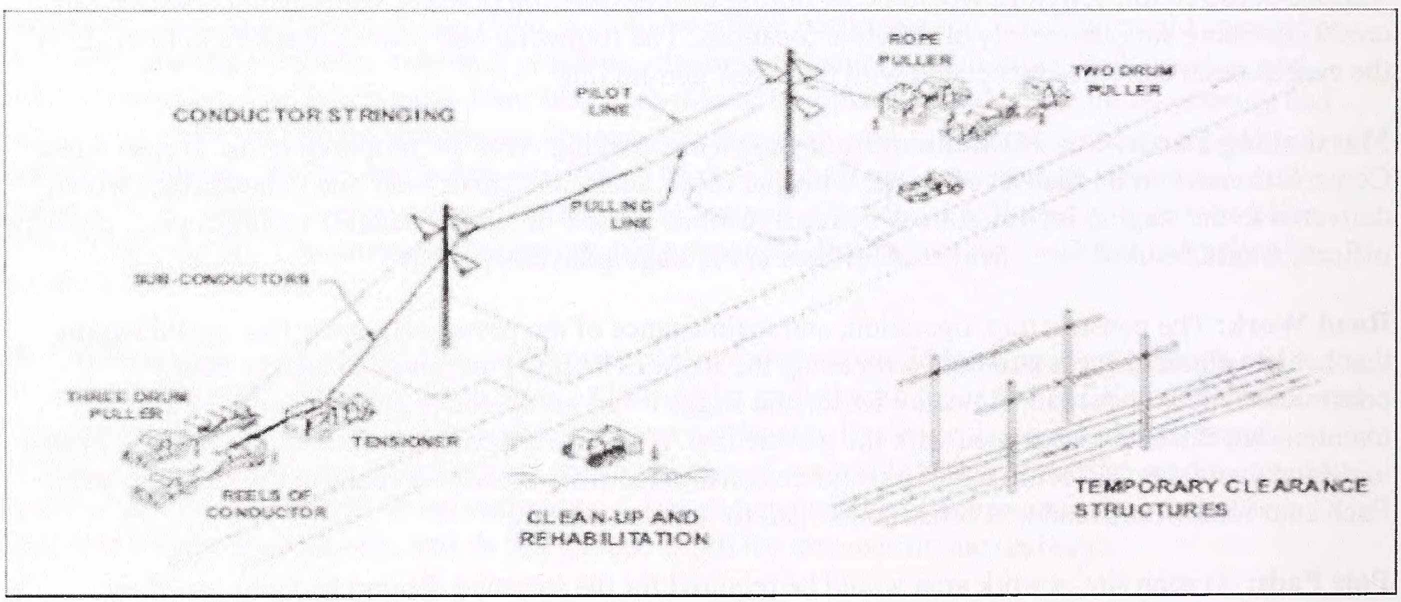

Figure 2.11 Illustration of transmission line conductor stringing.

Pulling Sites: The conductors would be strung using powered-pulling equipment at one end (see Figure 2.11). Powered braking or tensioning equipment would be approximately 1 mile apart. Tensioners and/or pullers, line trucks, wire trailers, and tractors needed for stringing and anchoring ground wire or conductor would be necessary at each pulling site. The tensioner, in concert with the puller, would maintain tension on the conductors while they would be pulled through the structures. There would be

approximately six pulling sites required to install the conductors along this segment of the gen-tie line. The sites would be accessed from SSEP access roads, Riggs Road, or SR-85.

The post-construction ROW would be restored, as required by the BLM. All practical means would be made to restore the land to its original natural drainage patterns.

2.5.3.3.2 Natural Gas and Water Pipelines

Construction of the 8-inch gas pipeline and water supply lines (see Map 2) would take approximately three to six months. Most major pieces of pipeline construction equipment would remain along the pipeline ROW during construction, with storage and staging of equipment and supplies either located in the Project Area or another acceptable site selected by the BLM at the time construction is underway. Excavated earth material would be stored in the construction ROW. During nonworking hours, any open trench would be covered with wood or other material of sufficient strength to support wildlife or people. All construction disturbances would take place within a 50-foot temporary disturbance ROW centered on the pipeline and trench. Where a pipeline or pipelines are coincident with a road, the total, temporary disturbance ROW width would be 65 feet. Although they would use the same ROW in some areas, the water supply pipeline would be installed early in the construction schedule, and would not share a trench with the gas pipeline.

It is anticipated that the construction of the natural gas and water pipelines would generally consist of the following elements:

Trenching: The optimal trench would be approximately 48 inches wide and 4 to 10 feet deep. With loose soil, a trench up to 8 feet wide at the top and 3 feet wide at the bottom may be required. The trench depth would provide a minimum cover of 36 inches.

Stringing: The pipeline components would be staged along the trench on wooden skids in preparation for installation.

Installation: Consists of bending, welding, and coating the weld-joint areas of the pipe after it has been strung, padding the ditch with sand or fine spoil, and lowering the pipe string into the trench following nondestructive testing of all welds.

Backfilling: Consists of returning spoil back into the trench around and on top of the pipe, ensuring that the surface is returned to its original grade or level. The backfill would be compacted to protect the stability of the pipe and minimize subsequent subsidence.

Trenchless construction methods may be used for short crossings under existing water lines or other buried pipelines. Boring pits would be dug on each side of the crossing to accommodate the process. Clean up would consists of restoring the surface of the roadway or ROW by removing any construction debris, grading to the original grade and contour, and revegetating or repairing, where required.

Each pipeline would undergo hydrostatic testing that involves filling the line with water, venting all air, increasing the pressure to the specified code requirements, and holding the pressure for a period of time. After hydrostatic testing, the test water would be chemically analyzed for contaminants and discharged to the surrounding area pursuant to the SSEP construction stormwater pollution prevention plan, unless the analysis shows that the water is contaminated; in which case, the water would be trucked to an appropriate disposal facility. Following hydrostatic testing, the gas pipeline would be cleaned and dried, purged of air, and filled with natural gas for operation. The water line would be put into use immediately following disinfection and testing.

2.5.3.4 OPERATIONS

2.5.3.4.1 Operations Staff and Vehicles

The operations workforce would consist of about 82 full-time employees for the entire facility, consisting of plant operators, maintenance technicians working 12-hour shifts per day, and administrative personnel working eight-hour shifts per day. The facility would be operated seven days a week, 24 hours a day, 365 days a year.

Operation and maintenance vehicles would include large trucks for on-site welding, refueling, lubricating, and watering (mirror washing). In addition, flatbed trucks, dump trucks, front-end loaders, and ¾-ton pick-up trucks are typical on-site vehicles operated regularly. Large heavy-haul transport equipment would be brought to the site as needed for major plant maintenance and equipment repair.

2.5.3.4.2 Operation and Maintenance Activities

The plant would be maintained by staff personnel for normal preventive maintenance. This would include daily inspection of field components, condition assessment of critical equipment, and routine lubrication of equipment. Some specialized maintenance would be performed by the technology provider or other outside specialist contractors. It is expected that long-term maintenance would be performed against a defined service and replacement schedule. It is expected that consumption of spare parts would be minimal. The SSEP would be repainted on a regular basis to maintain its appearance and protect it from the elements.

Periodic cleaning of the solar collectors with demineralized water would be necessary to maintain the desired mirror reflectivity. For a solar thermal facility, the mirrors would be washed during the off-peak hours for approximately 12 hours. Cleaning activities are a continuous process and would be conducted nightly. By washing a section of mirrors each night, the entire field can be cleaned over a period of two weeks. The process would then begin again.

Under normal circumstances, the plant switchyard would be controlled remotely, and routine inspections by personnel would occur on a monthly basis or as needed under emergency conditions. In addition, all of the switchyard structures would be annually inspected from the ground for corrosion, misalignment, and foundation condition. Ground inspection would include the inspection of hardware, insulator keys, and conductors. This inspection would also check conductors and fixtures for corrosion, breaks, broken insulators, and bad splices.

Road maintenance would be performed, as needed. Paved roads would be swept, sealed, and/or overlaid as needed. Grading and drainage would be maintained for gravel and earthen roads. Dust palliatives would be applied, as required, to limit fugitive dust.

Electric lines, support systems, and instrumentation and controls would be inspected regularly to ensure the safe, efficient, and economical operation of the SSEP.

The on-site wells would undergo periodic well workovers to remove sediment and other debris to maintain the flow. The pumps may also require periodic removal and servicing, which would require the occasional use of permanent service roads to the well sites.

The water storage tanks that would be installed as part of the SSEP would require frequent inspection and may need occasional repairs. This maintenance would include routine painting of the storage tanks to protect them from corrosion.

2.5.4 Water Use and Waste Management

2.5.4.1 WATER TREATMENT AND USE

2.5.4.1.1 Water Requirements

The SSEP would have various consumptive water uses, including the circulating water system, the solar steam generators, water for solar collector mirror washing, service water, potable water, and fire protection water. The estimated water requirements for the power plant are presented in Table 2.7. The average total annual water usage is estimated to range between 2,305 and 3,003 afy, depending on the amount of thermal storage and gas co-firing used (Table 2.7; see Figure 2.15). This corresponds to an estimated average daily usage of 6.3 to 8.2 acre-feet per day. Usage rates would vary during the year and would be higher in the summer months when the peak daily usage is estimated to be as high as 11.9 to 12.8 acre-feet per day.

Equipment sizing would be consistent with peak daily rates to ensure adequate design margin. The groundwater production well field would be designed with a capacity of 13.3 acre-feet per day to ensure that daily makeup water requirements would be met during the summer months. Higher instantaneous peak maximum flow requirements would be met by relying on the capacity of the raw water storage tank.

Table 2.7 Typical Water Usage Estimate – Proposed Action

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	8.2	12.8	3,003
Minimum (assumes solar production only)	6.3	11.9	2,305

[1]The estimate of groundwater usage is based on an average daily consumption rate for one 125-MW power plant and one 250-MW plant.

[2]The peak rate is the instantaneous maximum for summer usage for one 125-MW power plant and one 250-MW power plant.

Solar Mirror Washing Water

To facilitate dust removal, water from a demineralized water storage tank is used to spray clean the solar mirrors on a periodic basis. The frequency of the washing operation is determined by the reflectivity monitoring program. This operation is generally done at night and involves a water truck spraying demineralized water on the mirrors in a drive-by fashion. The demineralized water production facilities, already in place for solar steam generator make-up water, would be sized to accommodate the additional solar mirror washing demand of about 11.8 afy (4.45 acre-feet for the 125-MW unit and 7.37 acre-feet for the 250-MW unit). Water from the washing operation is expected to mostly evaporate on the mirror surface with no appreciable runoff.

Cooling Systems

The cooling system for heat rejection from the steam cycle consists of a surface condenser, circulating water system, and a wet-cooling tower (wet-cooling towers generally stand approximately 45–50 feet above grade). The surface condenser receives exhaust steam from the low pressure section of the steam turbine generator and condenses it to liquid for return to the solar steam generator. The surface condenser is a shell-and-tube heat exchanger with wet, saturated steam condensing on the shell side and circulating water flowing through the tubes to provide cooling. The warmed circulating water exits the condenser and flows to the cooling tower to be cooled and reused.

The circulating water is distributed among multiple cells of the cooling tower, where it cascades downward through each cell and then collects in the cooling tower basin. The mechanical draft cooling tower employs electric motor-driven fans to move air through each cooling tower cell. The cascading circulating water is partially evaporated, and the evaporated water is dispersed to the atmosphere as part of the moist air leaving each cooling tower cell. Because of climatic conditions at the site, visible moisture plumes are expected to occur relatively infrequently and largely in winter months, and no need for a plume-abated cooling tower is expected. The circulating water is cooled primarily through partial evaporation and secondarily through heat transfer with the air. The cooled circulating water is pumped from the cooling tower basin back to the surface condenser and auxiliary cooling water system.

2.5.4.1.2 Water Treatment

The raw water, circulating water, process water, and mirror washing water would all require on-site treatment that varies according to the quality required for each of these uses. The power plant's design consists of a pre-treatment system upstream of the cooling tower, and a post-treatment system downstream of the cooling tower. The water treatment plan was developed based on initial water analyses from on-site test wells. This water treatment design would be further evaluated on receipt of additional site-specific water quality data.

Water would be cycled in the cooling tower until the concentration of chemical constituents rises to levels where it could affect heat transfer and then becomes a waste stream (blowdown). The increase in concentration of constituents in the blowdown compared to the make-up water is called "cycles of concentration". The number of cycles of concentration in the cooling tower is limited by the incoming water chemistry and behavior of chemistry constituents as the concentration increases. Calcium and magnesium concentrations in the water are relatively low and would allow up to 15 cycles of concentration before potentially forming calcite ($CaCO_3$). Silica would be limited to six to seven cycles of concentration due to the formation of silicon dioxide (SiO_2) and magnesium silicate. TDS are high in the source water and would limit the cooling tower to five to six cycles to remain within cooling tower design limits.

Due to the limitation of these constituents in the process, a multimedia filter and two-stage reverse osmosis (RO) unit would be used for pre-treatment upstream of the cooling tower. This would allow the possible cycles of concentration to be increased to the 15 cycles required by ADWR and reduces the quantity of makeup water required. The waste stream from the multimedia filter unit is discharged into the on-site evaporation ponds, and the waste stream from the second RO unit is discharged into the wastewater storage tank.

Some contaminants (e.g., chloride, sodium, and sulfate) and scale-forming substances (e.g., calcium, magnesium, and silica) would not be removed during pre-treatment. Post-treatment would be used to recover most of the wastewater for reuse, to decrease the quantity of make-up water required, and to decrease the size of the waste management units (evaporation ponds). Post-treatment would consist of a multimedia filter and RO unit. Similar to the pre-treatment process, the multimedia filter would remove solids from the cooling tower blowdown that may damage or reduce the efficiency of the RO membranes. Water treated by the RO units would be returned to the cooling tower for reuse. Ultimately, the waste streams from the multimedia filter and second-stage RO unit would be discharged into on-site evaporation ponds.

Several on-site tanks would contain the raw water, treated water, and wastewater. These would have the following capacity:

- Raw Water/Fire Water Storage Tank:
  - 125-MW unit: 500,000 gallons
  - 250-MW unit 1,000,000 gallons
- Treated Water Storage Tank:
  - 125-MW unit: 1,250,000 gallons
  - 250-MW unit: 2,500,000 gallons
- Wastewater Storage Tank:
  - 125-MW unit: 250,000 gallons
  - 250-MW unit: 500,000 gallons

Tanks would be sized to provide sufficient water to support operation of the plant during peak operating conditions, as well as to provide a 12-hour storage capacity to enable continued operation when a failure interrupts water or wastewater treatment capabilities. The tanks also allow the plant to level the water supply requirements on a 24-hour basis and accommodate mid-day demand peaks. The raw water/fire water storage tank provides water for plant operation and fire protection.

In addition to the treatment of water for the cooling tower, there is also a demineralizer treatment process for the high-purity water required for the steam cycle.

On-site groundwater wells would also be used to supply water for employees' use (e.g., drinking water, showers, sinks, and toilets). A package water treatment system would be used to treat the water to meet potable standards.

Circulating Water Treatment

Circulating water would be modified with chemical treatment to prevent the growth of bacteria, the formation of scale, and the minimization of corrosion of the cooling tower fill and the condenser tubes. These chemicals include a biocide, a pH-control solution, a scale inhibitor, and a corrosion inhibitor. Some of these chemicals could be hazardous. At a minimum, the pH-control chemicals would be treated as a safety hazard. All chemical tanks would have secondary containment. All chemical totes/drums would be placed on containment pallets. A full spill prevention plan (SPP) would be developed and implemented prior to delivery of any hazardous chemicals.

Steam Cycle Process Water

Make-up water for the steam cycle must meet stringent specifications for suspended and dissolved solids. To meet these specifications, water from the treated water tank of each unit is processed through a separate demineralized water make-up system, each consisting of mixed-bed demineralizers and an 75,000-gallon (for the 125-MW plant) to 125,000-gallon (for the 250-MW plant) demineralized water storage tank. Additional conditioning of the condensate and feedwater circulating in the steam cycle is provided by means of a chemical feed system.

2.5.4.2 WASTE MANAGEMENT

Project wastes would include wastewater, nonhazardous solid waste, hazardous solid waste, and hazardous liquid waste. Project waste streams and management details are discussed in Chapter 4's hazardous and solid waste section.

2.5.4.2.1 Wastewater

Wastewater would be segregated into two separate collection systems, one for industrial streams and the other for sanitary wastes. For the 125-MW facility, industrial wastewater from both the pre-treatment and post-treatment systems would be piped to three approximately10-acre evaporation ponds for disposal. The evaporation ponds would have a combined area of approximately 30 acres for the 125-MW unit. For the 250-MW facility, industrial wastewater from both the pre-treatment and post-treatment systems would be piped to three approximately 20-acre evaporation ponds for disposal. The evaporation ponds would have a combined area of approximately 60 acres for the 250-MW unit. There would be three primary streams and one occasional waste stream discharging into the evaporation ponds:

1) Pre-cooling tower water treatment multimedia filter waste stream
2) Post-cooling tower water treatment multimedia filter waste stream
3) Post-cooling tower water treatment second stage RO waste stream
4) Stormwater accumulated in the land-treatment unit used to treat contaminated soils (occasional)

Annual average blowdown to the evaporation ponds would be approximately 58,000 gallons per day (gpd) for the 125-MW unit and 116,000 gpd for the 250-MW unit (174,000 gpd total). This would increase to approximately 104,000 gpd and 209,000 gpd (313,000 gpd total), respectively, during peak summer conditions.

The SSEP's sanitary system would collect wastewater from sanitary facilities such as sinks and toilets. This waste stream would be sent to an on-site sanitary waste septic system designed and permitted in accordance with Maricopa County Department of Health Services standards.

2.5.4.2.2 Evaporation Ponds

The average pond depth would be 3 feet, and residual precipitated solids would be removed approximately every 30 years to maintain a solid depth of no greater than approximately 3 feet for operational and safety purposes. The pond liner system would consist of a 60-mil high density polyethylene (HDPE) primary liner and a secondary 40-mil HDPE liner. A synthetic drainage geonet and collection piping (that is used as part of the leachate collection and removal system) would be installed between the liners. There would be a hard-surface, protective layer on top of the 60-mil HDPE, which would consist of a nonwoven geotextile, a 1-foot-thick granular fill/free draining material and a 1-foot-thick hard surface such as roller-compacted concrete. The hard surface provides protection against accidental damage to the HDPE from falling objects, varying climatic conditions, and worker activities during cleanout and maintenance. The evaporation ponds would be monitored to detect the presence of liquid and/or constituents of concern. Based on the experience at other solar facilities, it is expected that the constituents of concern for this monitoring would include chloride, sodium, sulfate, TDS, biphenyl, diphenyl oxide, potassium, selenium, and phosphate. None of these constituents are classified as hazardous. The HTF is comprised entirely of Biphenyl and diphenyl oxide. These constituents and any listed or known breakdown products would be part of the monitoring program.

The evaporation ponds would be subject to design requirements pursuant to the Arizona APP program. The Arizona regulations related to hazardous wastes do not address the potential for leakage or leaching releases, but defer to the state APP program. The pond designs would be reviewed and approved as part of the APP. Design measures that would be adopted to ensure that leakage would not impact underlying soil or create a waste water release would include a dual polymer liner and leak detection systems.

2.5.4.2.3 Heat Transfer Fluid Land-treatment Unit

HTF-impacted soils would be characterized as hazardous or nonhazardous waste to determine whether the material could be treated in the land-treatment unit or must be removed for off-site disposal. HTF-impacted soils would be promptly excavated and relocated to a staging area and characterized in accordance with Arizona and federal law. Based on the proponent's past experience at other solar thermal plants, it is anticipated that soil containing 5,000 milligrams per kilogram (mg/kg) HTF or more would be managed as hazardous waste, and that soil containing less than 5,000 mg/kg HTF would be nonhazardous waste and can be managed at the site. If the soil is characterized as a hazardous waste, the impacted soils would be transported from the site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill. No HTF-impacted soils characterized as hazardous waste would be disposed or treated on-site.

If the soil is characterized as a nonhazardous waste, it would be placed in the land-treatment area (see Map 2). Treatment of the HTF-impacted soil in the land-treatment unit would involve spreading, turning, moisture conditioning, and may involve the addition of nitrogen and phosphorous nutrients (i.e., fertilizers), as needed, to stimulate consumption of HTF by the indigenous bacteria. In general, more highly impacted soil may be covered with plastic sheeting to prevent contact with stormwater and to control potential odors and emissions, as well as for moisture and temperature retention. Once the soil has been treated to a concentration of less than 100 mg/kg HTF, it would be moved from the land-treatment unit to another portion of the site until it is reused at the facility as fill material.

Based on available operation data from other sites, it is anticipated that approximately 30 CY (on average) of HTF-affected soil with greater than 5,000 mg/kg HTF may be generated per year and managed as hazardous waste, as described above. HTF-affected soil with less than 5,000 mg/kg HTF is anticipated to be approximately 2,250 CY per year. Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

2.5.4.2.4 Other Nonhazardous Solid Waste

Construction, operation, and maintenance of the SSEP would generate nonhazardous solid wastes typical of power-generation or other industrial facilities. These wastes include scrap metal and plastic, insulation material, paper, glass, empty containers, and other miscellaneous solid wastes. These materials would be disposed of by means of contracted refuse collection and recycling services.

2.5.4.2.5 Hazardous Solid and Liquid Waste

Small quantities of hazardous wastes would be generated during SSEP construction and operation. Less than 100 kg/month would be generated during operations. Hazardous wastes generated during the construction phase would include substances such as paint and primer, thinners, and solvents. Hazardous solid and liquid waste streams generated during SSEP operations include substances such as used hydraulic fluids, oils, greases, filters, as well as spent cleaning solutions and spent batteries.

Herbicides would be used in the solar field to control vegetation during operation of the SSEP, with a maximum of approximately 37,000 pounds of herbicide used annually. Herbicide would not be stored on-site.

2.5.5 Termination and Reclamation

BLM IM No. 2011-003 (Solar Energy Development Policy) indicates that due to the substantial investment required for solar energy projects, it is in the public interest to provide a ROW authorization term that allows a reasonable period of time for construction, development, and continued operations. The IM states that the BLM will issue all solar energy ROW authorizations for a term not to exceed 30 years. This timeframe provides a reasonable period for the expected needs of a solar energy facility, as well as an operation period that allows for typical power purchase agreements. A 30-year ROW authorization is proposed under all action alternatives. The ROW authorization would include a specific provision allowing for renewal, consistent with 43 CFR § 2807.22. However, because the BLM cannot predict conditions 30 years into the future, this analysis assumes that 30 years would be the extent of the useful life of the project.

Boulevard would be required to post a performance and reclamation bond as a condition of authorization issuance. The value of this bond would be based on three components, as identified in BLM IM No. 2011-003. The first component would consider environmental liabilities, such as risks associated with hazardous waste and hazardous substances. The second component would address the decommissioning, removal, and proper disposal, as appropriate, of improvements and facilities. The third component would evaluate reclamation, revegetation, restoration, and soil stabilization activities associated with the Proposed Action. Bond amounts would be determined upon further project review by the BLM but could be reduced through limited herbicide use and hazardous waste production, a smaller project footprint, and/or decreased grading and vegetation removal in the Project Area

2.5.5.1 TERMINATION

The SSEP would have a useful life of at least 30 years. At the end of the useful life of the facility and the termination of the ROW grant, Boulevard would remove all improvements. During improvement removal, the site would be securely fenced and gated. Materials that could be reused or recycled would be hauled away from the site and sold. Materials that could neither be reused nor recycled would be dismantled and hauled to the nearest approved landfill. Hazardous materials that could not be reused or recycled would be disposed of at approved facilities. Boulevard would remove foundations to 3 feet below ground surface, restore contours over the foundations to pre-project conditions, remove the stormwater management berms, and restore the pre-project contours.

The transmission line and towers would be removed. Conductors and tower steel would be sold for reuse or recycling. The switchyard, including all structures and fencing, would be removed. Foundations for the towers and switchyard facilities would be removed to 3 feet below ground surface and contours restored.

Because removal of the natural gas pipeline would disturb more ground than abandoning it in place, it would be internally cleaned, purged free of gas, isolated from interconnections with other pipelines, and sealed without being removed from the trench. This approach generally minimizes surface disturbance and other potential environmental impacts. The aboveground pipeline at the meter station would be completely removed, including all related aboveground equipment and foundations, and the station sites would be restored to as near original condition as possible. Upon abandonment of the pipeline, the BLM ROW would be relinquished.

It is not possible to predict the conditions and management objectives that would exist at the time of decommissioning. Therefore, decommissioning details would be developed and provided to BLM when the time for permanent closure is closer and more information is available. The BLM would require Boulevard to submit an abandonment plan that would be reviewed and revised as needed in order to be approved by the BLM. The plan would include all activities required to dispose of or store all hazardous

and toxic materials and chemicals associated with the SSEP. This plan would discuss all currently applicable LORS associated with the safe storage or disposal of these materials. The plan would also include a description of procedures for notification of regulatory agencies. The BLM would review and approve the plan.

2.5.5.2 RECLAMATION

Site reclamation would be the responsibility of the entity holding the ROW grant at the time of closure and decommissioning of the project. To comply with current BLM guidance (BLM IM No. 2011-003), as a component of the POD, Boulevard would submit a decommissioning and site reclamation plan (DSRP) to define the general reclamation, revegetation, restoration, and soil stabilization requirements for the Project Area. The DSRP would require timely reclamation of construction areas and the revegetation of disturbed areas. It must be approved by the BLM prior to the grant of the ROW. The approved DSRP would be the basis for determining the standard for reclamation, revegetation, restoration, and soil stabilization of the Project Area and also for establishing the full bond amount.

A brief description of reclamation activities is provided below. Reclamation would take approximately six months following decommissioning, with the exception of on-going monitoring.

2.5.5.2.1 Soil Preparation

Following project termination and removal of all waste materials and equipment, Project Area soils would be prepared for re-seeding by removing large rocks; running an imprint roller (in areas where it is effective) to create stable, 4-inch-deep impressions; and conducting soil testing to determine nutrients, pH, toxicity, and biological activity. Areas low in essential nutrients or in need of amendment could be fertilized/amended before planting. The fertilizer/amendment would be drilled or harrowed into the soil. Nitrogen fertilizers would be selected to release at the time of seed germination to avoid nitrogen loss.

2.5.5.2.2 Re-seeding

Following soil preparation, reclamation areas would be seeded with a native seed mix. The seed mix would be selected to suit the soil type and climate and would contain a mixture of grasses, forbs, shrubs and other appropriate plants that provide for quick cover, embankment stabilization, litter production, nitrogen fixing, and other desirable qualities. Native plant species growing near the Project Area would be used as a guide in seed selection. A suggested seed mix is given in Table 2.8. This mix would be approved by the BLM prior to reseeding activities.

Table 2.8 Seed Mix for Reclamation Activities – Proposed Action

Species	Application (pounds/acres)
Grasses	
Aristida purpurea (purple three awn)	1
Wildflowers and Forbs	
Baileya multiradiata (desert marigold)	1
Cassia covesii (desert senna)	1
Eschscholzia mexicana (Mexican poppy)	1
Lupinus sparsiflorus (desert lupine)	2
Penstemon pseudospectabolis (desert penstemon)	1
Penstemon parryi (Parry penstamon)	1
Phacelia crenulata (phacelia)	1
Plantago insularis (wooly Indian wheat)	5
Sphaeralcea ambigua (desert globemallow)	1
Shrubs and Trees	
Acacia greggii (catclaw acacia)	2
Ambrosia deltoidea (triangle leaf bursage)	4
Atriplex canescens (four-wing saltbush)	1
Calliandra eriophylla (fairy duster)	2
Cercidium microphyllum (foothills palo verde)	2
Parkinsonia floridum (blue palo verde)	1
Encelia farinosa (brittlebush)	1
Erigonum fasiculatum (Arizona buckwheat)	1
Larrea tridentate (creosotebush)	3
Viguiera deltoidea (golden-eye)	1

Seedbed preparation and seeding would be done in the fall before the winter rains. Cellulose fiber mulch would be added to the seed mix at the rate of 200 pounds per acre on any slopes. A tackifier would be added to the solution to bind the soil and mulch, and supplemental watering of the seed mixture would be provided if seasonal rains are lacking.

2.5.5.2.3 Monitoring

Boulevard would be required to monitor reclamation quarterly for the first year to repair washouts and would re-seed as necessary. After the initial year, Boulevard would inspect the property annually for at least the following two years during the growing season and take remedial measures, as required, until plant survival is satisfactory to the BLM. The revegetation goal would be to establish ground cover with native species equal to that on adjacent undisturbed areas within three growing seasons. Achieving this goal would be measured by aerial photography or by line-intercept survey methods. Sampling would be sufficient to assure that the revegetated area achieved at least 80% of the true mean cover of the reference (undisturbed) site.

2.5.5.2.4 Evaporation Pond Remediation

The remediation activities for evaporation ponds would include the following processes.

Removal of Wastewater

Wastewater remaining in the evaporation ponds would be allowed to evaporate. As long as liquids remain in the evaporation ponds, the monitoring and reporting requirements included in the permit requirements would be followed.

Removal of Solids/Sludge

Samples of the precipitated solids/sludge would be collected from each evaporation pond for characterization and profiled for disposal. The characterized solids/sludge would then be loaded into containers and handled as appropriate by a licensed waste hauler and would be transported to an approved disposal facility.

Removal of Hard Surface/Protective Layer

The hard protective layer of roller-compacted concrete would be removed using best engineering practices. Three samples of concrete would be collected from each evaporation pond to determine if the concrete can be recycled. If recyclable, the concrete would be crushed on-site and transported to construction site(s) for use as road base material or as backfill material at depths of greater than 3 feet below final grade.

The granular fill beneath the hard surface protective layer would be removed. The material would be transported to an on-site facility to be washed. Water generated from the washing activities would be loaded in appropriate containers, handled, and transported by a licensed waste hauler to an approved disposal facility. The washed material would be reused on-site as granular fill.

Removal of High Density Polyethylene Liners, Drainage Layers, and Leak Detection System

In each evaporation pond, the HDPE liners, drainage layers, and leak detection, collection, and recovery sumps would be removed. The materials would be sent to a disposal facility. Confirmation sampling would be conducted on the clay layer of the evaporation pond liner system after the removal of the 40-mil HDPE geomembrane.

Site Restoration

The evaporation ponds would be backfilled with native soil to match the existing surrounding grade and to restore drainage function. The berm surrounding each evaporation pond and the washed granular material would be the primary backfill material. The upper 6 inches of soil would be decompacted as necessary and remediated to accepted conditions.

2.5.6 Disturbance Assumptions

The estimated disturbance requirement for the construction and operation of the Proposed Action are detailed in Table 2.9 and Table 2.10. Temporary disturbance areas would only be used during the SSEP's construction phase, and the areas would immediately be reclaimed following termination of their use (Note: temporary disturbances may result in short-term impacts [persisting five years or less] or long-term impacts [persisting greater than five years] depending on how and where they occur. This is discussed in

Chapter 4. Permanent disturbances are those that would persist for the life of the SSEP. Where temporary disturbances would occur in areas of permanent disturbance, they are not included in the acres presented. Several of the temporary and permanent disturbance areas in these tables overlap (such as gas and water pipeline ROWs), so these areas are not mutually exclusive. Please refer to Table 2.15 (Comparison of Alternatives) for the acres of temporary and permanent disturbance under the Proposed Action and the other alternatives.

Table 2.9 Temporary Disturbance Assumptions

Temporary Disturbance Areas	Assumed Dimension
Transmission line construction laydown/assembly	100' × 200'
Transmission conductoring pulling area[a]	50' × 140'
Transmission pole pad construction area[b]	50' × 50'
Gas line construction ROW	50' width
Water line construction ROW	50' width
Site, spur, and well field access roads construction ROW	50' width
Any shared ROW (e.g., road and pipeline)	65' width

[a] Except three-pole structures, which would be approximately 75' x 140'.
[b] Except three-pole structures, which would be approximately 50' x 150'.

Table 2.10 Permanent Disturbance Assumptions

Permanent Disturbance	Assumed Dimension
Transmission pole pads[a]	40' × 40'
Transmission line spur roads	24'
Switchyard expansion	n/a
Primary access road (from SR-85 to solar fields)	50'
Secondary access roads (improved existing roads and new roads)	24'
Gas line	n/a
Water line	n/a
Groundwater well area	200' × 200'

[a] Except three-pole structures, which would be approximately 40' x 140'.

2.6 Alternative A: Reduced Water Use (dry-cooled CST)

2.6.1 Introduction

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be constructed using a dry-cooling technology rather than the wet-cooling technology considered under the Proposed Action. Because no water would be used for primary cooling, consumptive evaporative losses would be considerably lower under this alternative than under the other action alternatives. Alternative A would require approximately 116 to 151 afy for operations, which would be supplied by two groundwater wells located in the same area as under the other action alternatives. Under Alternative A, dry cooling would be less efficient than wet cooling and would generate less electricity from the same sized solar field. There is no additional space within the SSEP layout to increase the solar field. The size of the solar field within the main project footprint was maximized to the extent possible; however, limitations in land availability precluded optimizing the dry-cooled solar field, resulting in a decrease in anticipated electrical production. Total solar generation under Alternative A would be approximately 9% less than the anticipated generation under the Proposed Action.

Based on publicly available sources (LAZARD 2008, SEIA 2010, WorleyParsons Group 2008), the estimated capital cost of the Alternative A facility would be between $1.8 and $2.5 billion (see Table 2.15). This cost includes capitalized interest costs during construction, operation and maintenance costs, and fuel prices. **In general, most aspects of Alternative A would be the same as under the Proposed Action. As such, only those subsections and details that would differ substantively from the Proposed Action are discussed below under Alternative A.** The alternatives are quantitatively compared in Section 2.12, Table 2.15.

2.6.2 Proposed Facilities and Infrastructure

2.6.2.1 COOLING SYSTEM

Under Alternative A, the SSEP would use an ACC for power plant cooling (instead of a wet-cooling tower, as under the Proposed Action and Alternative B [Reduced Footprint]). ACCs generally stand approximately 95–100 feet above ground surface, compared to wet cooling towers, which generally stand 45–50 feet above grade. One ACC would be installed in each power block. In addition, each power block would include two "wet surface air coolers" that would be used for auxiliary cooling. Because this alternative would not employ a cooling tower, make-up and evaporative losses would be minimized.

The cooling system for heat rejection from the steam cycle would incorporate an ACC unit. Steam would exhaust directly from the steam turbine generator to an exhaust header that leads to a multi-cell ACC. In the ACC, the wet steam is converted to condensate in a series of tubes with external fins to facilitate better heat transfer. On the outside of the tubes, ambient air is forced over the tubes using large mechanical fans. The exhaust steam is distributed throughout the ACC through a series of smaller and smaller headers. At low points in each ACC, the condensate water is collected and returned to the solar steam generator. All cooling takes place by convective heat transfer to the air.

An auxiliary cooling system capable of providing lower cooling water temperatures than a dry-cooled system must be provided for multiple equipment heat loads. A wet surface air cooler (WSAC) would be installed to provide cooling of the auxiliary system circulating water. The closed-loop circulating water would pass through tubes the same way as the steam in the ACC. The WSAC would operate in the same

fashion as the ACC with the added feature of water being sprayed over the tubes to enable evaporative cooling and thereby lowering the attainable circulating water temperature in the tubes. Water sprayed over the tubes would fall into a water collection basin and then discharged to the evaporation ponds. The WSAC would be designed as a once-through system thereby not requiring additional circulating pumps for the spray water or a substantial basin to act as a hot well.

2.6.2.2 EVAPORATIVE PONDS

No cooling water blowdown (wastewater) would be generated under Alternative A. Therefore, the evaporation ponds would only handle wastewater from the WSAC blowdown and RO reject (see description of dry-cooling process below), and would be smaller than under the Proposed Action (Map 5). The same number of ponds (six) would be used, but each pond would be approximately 2 acres for 125 MW and 4 acres for 250 MW (instead of 10 acres and 20 acres, respectively, under the Proposed Action).

2.6.2.3 WELL FIELD

Water demands under Alternative A would require two groundwater wells (compared to four under the Proposed Action). Although the water needs of the SSEP could likely be met with the capacity of a single well, two wells would be drilled and developed to ensure redundancy and reliability. In addition, the groundwater production well field would be designed with a capacity of 1,000 gpm (compared to 3,000 gpm under the Proposed Action).

2.6.2.4 POWER BLOCKS

A slightly higher percent of the steam turbine generator output would be used on-site for plant auxiliary loads such as motors, heaters, control systems, and general facility loads (e.g., lighting and heating, ventilation, and air conditioning) under Alternative A than under the Proposed Action. For the purposes of analysis, this on-site load is still assumed to be approximately 10%.

Under Alternative A, less efficient dry cooling would allow less energy production from the same sized solar field than under the wet-cooled Proposed Action. Total solar generation would be approximately 9% less than the anticipated generation under the Proposed Action. The allowable gas-fired generation (no more than 25%) would drop proportionally (about 9%) to an approximate maximum of 3,623,620 MMBtu per year, or 3,549 million standard cubic feet per year.

2.6.3 Construction and Operations

The construction schedule under Alternative A would be the same as under the Proposed Action. However, construction would require an average of 900 employees (instead of 870) over the same 39 month period due to the longer ACC construction time.

2.6.4 Water Use and Waste Management

2.6.4.1 WATER REQUIREMENTS

As described above, the cooling system used under Alternative A would use air rather than water for heat rejection from the steam cycle. The estimated consumptive water usage under this alternative is show in Table 2.11.

Table 2.11 Typical Water Usage Estimate – Alternative A

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	0.4	0.4	151
Minimum (assumes solar production only)	0.3	0.4	116

[1] The estimate of groundwater usage is based on an average daily consumption rate for one 125-MW power plant and one 250-MW plant.

[2] The peak rate is the instantaneous maximum for summer usage for one 125-MW power plant and one 250-MW power plant.

2.6.4.2 WATER TREATMENT

A water treatment plan was developed based on initial water analyses from on-site test wells. The raw water, process water, and mirror washing water all require on-site treatment, which varies according to the quality required for each of these uses. The power plant's design would consist of a pre-treatment system upstream of the raw water, and a demineralized water system. This water treatment design would be further evaluated on receipt of additional site-specific water quality data.

A multimedia filter was selected for pre-treatment upstream of the raw water tank. The multimedia filter would remove solids or particulates from the make-up water that may damage or reduce the efficiency of the WSAC included for auxiliary cooling. The waste stream from the multimedia filter unit would be discharged into the on-site evaporation ponds. No cooling water chemical treatment would be required because the WSAC would be a "once-through" design with a cycle of concentration of one.

The demineralized water treatment system would consist of RO units followed by either mixed bed demineralizers (MBD) or electrodeionization units (EDI). The RO train would be fed by the raw water tank. RO product (permeate) would then be fed to the MBD or EDI train where demineralized water is generated and stored in the demineralized water storage tank for steam-cycle makeup and mirror washing. The RO waste stream would be combined with the multimedia filter waste stream and discharged to the evaporation ponds.

There would be several tanks on-site that would contain the raw water, RO feedwater, and demineralized water, which would have the following capacity:

- Raw Water/Fire Water Storage Tank:
  - 125-MW unit: 500,000 gallons
  - 250-MW unit 1,000,000 gallons
- RO Feedwater Storage Tank:
  - 125-MW unit: 100,000 gallons
  - 250-MW unit: 200,000 gallons
- Demineralized Water Storage Tank:
  - 125-MW unit: 75,000 gallons
  - 250-MW unit: 150,000 gallons

Tanks would be sized to provide sufficient water to support operation of the plant during peak operating conditions, as well as to provide a 12-hour storage capacity to enable continued operation when a failure

interrupts water or wastewater treatment capabilities. The tanks would also allow the plant to level the water supply requirements on a 24-hour basis and accommodate mid-day demand peaks. The raw water/fire water storage tank would provide water for plant operation and fire protection.

2.6.5 Termination and Reclamation

The methods, timing, and requirements for termination and reclamation would be the same under Alternative A as under the Proposed Action. Because of differences in the design and layout of the well field, slightly different acreages would be reclaimed on termination of the SSEP.

2.7 Sub-alternative A1: Photovoltaic

2.7.1 Introduction

Sub-alternative A1 was developed to respond to public and agency comments on water consumption. It was developed after the draft EIS due to advancements in technology and a change in market conditions that allowed a reconsideration of PV technology as a viable alternative (see Section 1.2). As described in Section 2.1, the addition of this sub-alternative did not require supplementation of the EIS because it is within the spectrum of alternative impacts already considered. Under Sub-alternative A1, the SSEP would be constructed as a 300-MW PV power plant. The plant would generate electricity using multiple arrays of PV panels electrically connected to associated power inverter units. The current from the power inverters would be gathered by an internal electrical collection system and transformed to transmission voltage prior to leaving the Project Area (Figure 2.12). Sub-alternative A1 would not require any consumptive water use for the generation of electricity, although limited quantities of water would be required for potable use by employees, panel washing, and other general uses. Along with a reduction of generating capacity, this sub-alternative would allow a reduced project footprint and decreased water consumption relative to the Proposed Action. It would also avoid other resources raised as issues by the public and agency cooperators, including wildlife habitat and travel corridors, pending FEMA floodplains, air quality point sources and vapor plumes, and nearby residences.

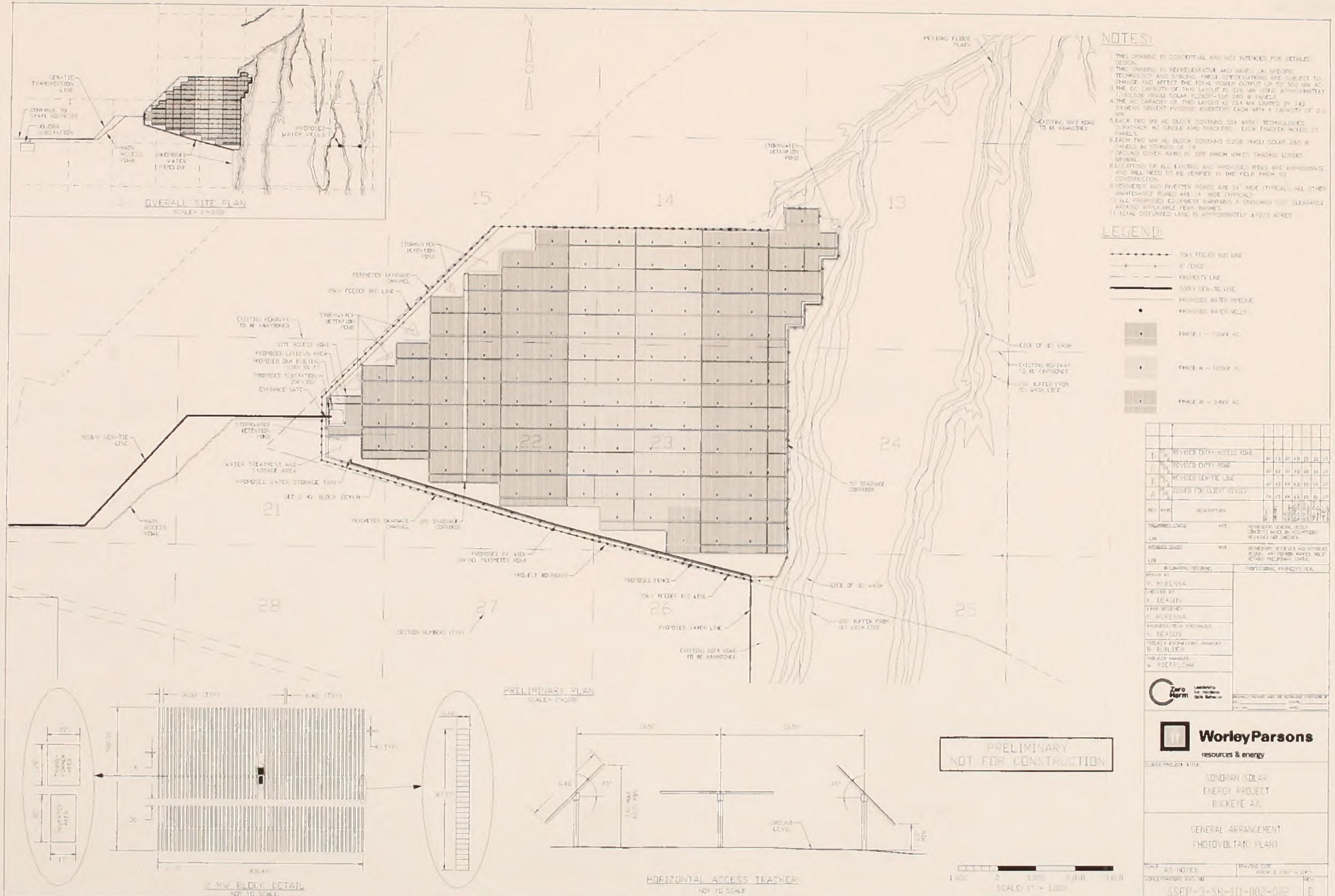

Figure 2.12. Conceptual site layout under Sub-alternative A1.

The main project footprint (not including linear features such as roads, pipelines, or transmission lines) under Sub-alternative A1 would occupy approximately 1,907 acres, or 56% of the footprint under the Proposed Action (Map 4). Sub-alternative A1 would require approximately 33 afy of water for operations (and an annual average of 65 afy of water over the life of the project with construction use factored in), which would be supplied by up to two groundwater wells in the same area as under the other action alternatives. Total solar generation would be approximately 20% less than the anticipated generation under the Proposed Action. Based on publicly available sources (Barbose et al. 2011, SEIA 2010, and WorleyParsons Group 2008), the estimated capital cost of the Sub-alternative A1 facility would be between \$1.1 and \$1.3 billion (see Table 2.15). This does not include labor, land, or operation and maintenance costs.

2.7.1.1 FACILITY LOCATIONS AND COMPONENTS

Under Sub-alternative A1, the total project footprint (all temporary and permanent use areas) would be approximately 2,013 acres. All other location details would be the same as under the Proposed Action.

Sub-alternative A1 would consist of three major types of facilities: 1) PV panel arrays within a graded solar field (the main project footprint), 2) linear facilities, and 3) a well field. Each of these components is shown on Figure 2.12 and Map 4 and explained in detail in the following sections. The amount of temporary (construction) and permanent (life of project) disturbance required for these facilities is described in detail in Sections 2.5.6 (Disturbance Assumptions for the Proposed Action, which would be the same as for this sub-alternative) and 2.13. Road improvements would be similar to the Proposed Action.

The PV panel array facilities would be located in approximately 1,907 graded acres in the primary project footprint. The entire primary footprint would be enclosed by fences. The Sub-alternative A1 facilities would include the following major components or systems:

- PV modules/arrays
- Solar trackers and/or fixed support structures
- Electrical collection system
- Step-up transformation/on-site switchyard
- Generation tie-line/utility interconnection
- Administration buildings and local warehouses
- Drainage collection and discharge facilities

As under the Proposed Action, a well field would be developed to supply water for the sub-alternative during the construction and operation phases. The well field would include up to two wells with on-site pumping facilities. Linear facilities would be similar to the Proposed Action, although no natural gas pipeline would be required.

2.7.1.2 PROCESS DESCRIPTION

Sub-alternative A1would use state-of-the-art PV technology where the sun's light energy is converted directly into DC electrical energy within the PV panels. PV panels generate electricity using the photoelectric effect, whereby the materials in the panels absorb sunlight's energy in the form of photons and release electrons. The capture of these free electrons produces an electrical current that can be collected and supplied to the electrical grid.

2.7.2 Proposed Facilities and Infrastructure

Sub-alternative A1would not incorporate any type of co-fire generation or TES into its design. The SSEP would produce electricity only when the available solar resource is sufficient. Consequently, substantial facility differences exist between Sub-alternative A1 and other alternatives discussed in this chapter.

2.7.2.1 PV PANEL ARRAY FACILITIES

2.7.2.1.1 PV Modules and Arrays

Under Sub-alternative A1, one hundred and fifty 2-MW AC arrays would be constructed for a total generating capacity of 300 MW. Each array would consist of a group of PV panels, referred to as "modules," which are grouped together to form a solar array. The size of the array is based on the capacity of the equipment selected and desired overall voltage and current output. Currently, the 2-MW arrays are proposed for the sub-alternative. However, solar energy technologies continue to evolve at a rapid rate; as a result, the exact arrangement and nature of the PV systems would be determined during the final design. Preliminary design features of the PV modules and arrays are provided in Figure 2.12. Each 2-MW array would consist of a transformer and inverter area, surrounded by 88-foot-wide by 6-foot-high modules, for a total of approximately 11 acres.

2.7.2.1.2 Solar Trackers and/or Fixed Support Structures

Exact module support structure types would be determined during the final design. The single axis tracker configuration is more complicated and is discussed in more detail below. A fixed support structure is also possible. In this application, the fixed structure would orient the panels in a permanent position toward the south at a certain angle to optimize production throughout the year without any mechanical movement or drive motors.

The PV module rows would be oriented north-south on single-axis trackers spaced approximately 16.5 feet between rows (post to post) to accommodate 12-foot clearance for maintenance vehicles and panel access and to increase the energy production from the arrays. Two types of tracker systems could be selected for Sub-alternative A1: a ganged system or a stand-alone tracker system. A ganged tracker system uses one motor to control multiple rows of PV modules through a series of mechanical linkages and gearboxes. A stand-alone system uses a single motor and gearbox for each row of PV modules. The exact tracker manufacturer and model would be determined in the final design; however, both trackers would function identically in terms of following the motion of the sun.

On-site power requirements for Sub-alternative A1 would be dependent on the tracker technology and any other ancillary plant equipment (such as lighting, security, etc). The tracker used in the preliminary design has a parasitic load of ~350 kilowatt-hours (kWh) per MW per year. This correlates to ~12 kW, which is roughly 0.004% of the plant's total power rating. Total on-site power demands (including trackers) would be under 5% during operating hours and under 0.5% during nonoperating hours due to the tare losses of the inverters (power consumed by the devices themselves). Therefore, the parasitic power consumption would be lower than the 10% on-site power load for the Proposed Action.

2.7.2.1.3 Plant Auxiliary Facilities

Sub-alternative A1would include an operations and maintenance facility, located near the primary access road and the 24-foot-wide security gate. The operations and maintenance facility would be a pre-engineered metal building with metal siding and roof. The building would provide a small administrative area, a work area for performing minor repairs, and a storage area for spare parts, transformer oil, and

other incidental chemicals. The total square footage of the various SSEP buildings and pre-engineered enclosures (e.g., control rooms, administration building, and warehouse) would be approximately 3,000 square feet (the Proposed Action would use approximately 60,000 square feet for the 250-MW and 125-MW units, for a difference of approximately 57,000 square feet less than the Proposed Action).

2.7.2.2 ELECTRICAL COLLECTION SYSTEM

PV modules generate a low-voltage DC electrical output that is not suitable for direct connection to the AC utility grid used in the United States. The electrical collection system would be designed to 1) transform the output power from the PV modules from DC to AC and then from low voltage to transmission level voltage for connection to the grid, and 2) supply power to each tracker's auxiliary electrical equipment and systems.

The DC current from the PV arrays would be transmitted to voltage inverters through underground DC electrical cables. As currently configured, Sub-alternative A1 would use 150 power inverter packages to accomplish the DC to AC power conversion process. The number of modules connected to each inverter is dependent on the specific model of modules, inverters, and their capacities, which would be selected in the final design. In the current design, 8,208 280-W DC panels would be connected to each 2-MW AC inverter package. This design uses a small amount of over-paneling so that the maximum DC power for each array (2.298-MW DC) is greater than the inverter package's power (2.0-MW AC). This over-paneling design forces the inverters to "clip" a small amount of energy during peak production hours (this is the DC input that cannot be used by the inverter due to inverter capacity). However, this allows for greater electrical production in off-peak hours for an overall increase in power production. The resulting AC current from each individual inverter package would then be routed through underground AC cables to the corresponding medium voltage, step-up transformer. Based on the preliminary design, the output voltage from each inverter (265 volts) would be increased to the desired substation feed voltage (34.5 kV) by these step-up transformers.

2.7.2.3 EVAPORATION PONDS

No cooling water blowdown (wastewater) would be generated under Sub-alternative A1. Therefore, the evaporation pond would only handle wastewater from the RO reject and would be smaller than under the Proposed Action. Only one approximately 1-acre pond would be required (instead of one 10-acre and one 20-acre pond under the Proposed Action).

2.7.2.4 LAND-TREATMENT UNIT

PV would not use HTF; therefore, no land-treatment unit would be required for Sub-alternative A1.

2.7.2.5 ON-SITE SWITCHYARD AND TRANSMISSION FACILITIES

2.7.2.5.1 Step-up Transformation/On-site Switchyard

The AC current would leave the step-up transformers via underground 34.5-kV lateral lines, which would be routed into overhead electrical feeder lines along the perimeter of the main project footprint. The feeder lines would be supported by double circuit 34.5-kV poles (Figure 2.13) and would dead end at the SSEP substation (see Figure 2.12). The SSEP substation would be located on an approximately 2.8-acre area on the western side of the solar field. The substation would consist of parallel sets of internal power distribution systems, (i.e., 34.5-kV buses and circuit breakers, disconnect switches, and main step-up transformers) to increase the voltage to the 500-kV transmission line voltage.

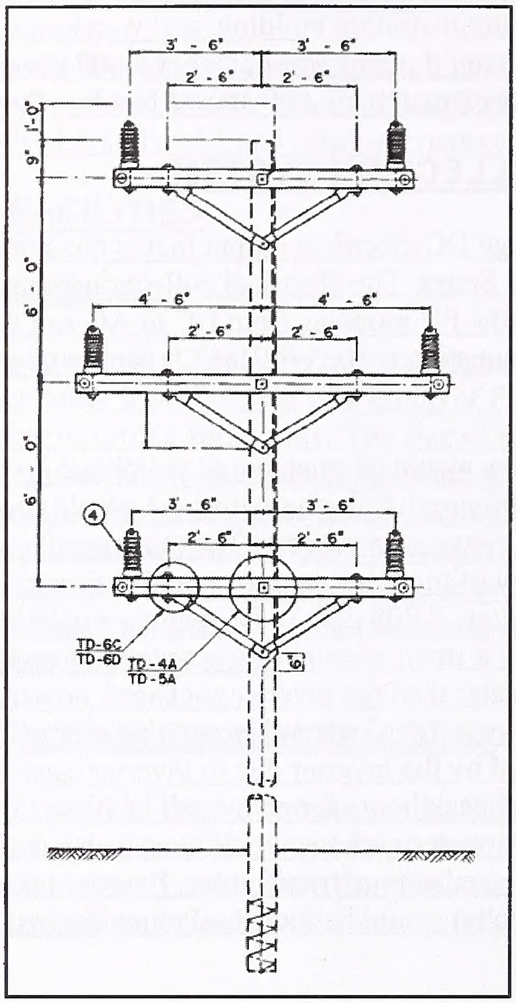

Figure 2.13 Typical feeder line structure.

The power from the combined solar arrays would be transformed from the medium distribution voltage (34.5 kV) to the 500-kV transmission line voltage. The substation and interconnections would be built for 500 kV and would operate at that nominal voltage.

2.7.2.5.2 Interconnection to the Jojoba 500-kV Switchyard

Transmission of electrical power to the grid under Sub-alternative A1 would be the same as under the Proposed Action.

2.7.2.5.3 Generation Tie Line

Transmission of electrical power through a gen-tie line under Sub-alternative A1 would be the same as under the Proposed Action.

2.7.2.6 NATURAL GAS PIPELINE

Sub-alternative A1, as a PV project, would not use natural gas co-firing. Consequently, no natural gas pipeline would be required as part of Sub-alternative A1.

2.7.2.7 OFF-SITE DRAINAGE COLLECTION AND DISCHARGE FACILITIES

Off-site drainage collection and discharge facilities for Sub-alternative A1 would be similar in concept to the Proposed Action. Off-site stormwater runoff would be collected and conveyed around the perimeter of the solar field, where it would be released back into the natural washes in a manner similar to the existing condition. The collection channels would be designed to collect and convey the 100-year, 24-hour storm event around the development, without impacting the SSEP. The channel bends would be rounded as much as practicable given available land constraints. In addition, the channel banks would be super-elevated per standard drainage engineering practice. A channel on the northwest side of the Project Area would serve to distribute the flow back into the natural washes at a rate equal to or less than the existing condition for each wash. There would be eight stormwater outfalls along the western edge of the Project Area and one stormwater outfall to a wash in the northeast portion of the Project Area (Map 4). The northeast stormwater outfall would discharge both rerouted water and water from the stormwater detention basins.

2.7.2.8 ON-SITE STORMWATER MANAGEMENT

Management of stormwater generated from Sub-alternative A1 would be similar in concept to the Proposed Action. The overall on-site drainage concept for Sub-alternative A1 is shown in Figure 2.14 and Maps 4 and 7. Stormwater generated on-site would sheet flow into smaller drainage channels, aligned east to west. These smaller east-west drainage channels would be compacted and stabilized trapezoidal earthen channels adjacent to (south of) the solar field interior access roads. The smaller channels would divert flows to larger drainage channels, aligned north to south adjacent to the solar field's perimeter road. The larger channels would be designed to be resistant to potential scour and would outfall into stormwater detention basins situated in the lower elevation areas of the solar field. Areas of the solar field that are in the Rainbow Wash watershed would be drained to a series of stormwater detention basins along the western side of the Project Area. The area of the solar field currently in the Waterman Wash watershed would drain to a detention basin in the north and east.

To the fullest extent possible, the detention basins would attenuate the post-development 100-year, 24-hour storm event runoff from the solar field and would outfall into the natural drainage system downstream (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the pre-developed 100-year, 24-hour storm event flow rate. The detention basins would discharge within 36 hours, thereby allowing sediments and on-site pollutants to settle out. The detention basins would also have emergency spillways to discharge runoff generated due to major rainfall events in excess of the 100-year, 24-hour storm. Emergency spillways would discharge into the proposed perimeter distribution channels, diverting the excessive flow away from the solar field. Riprap outlet protection at the stormwater outfalls and basin emergency spillways would dissipate the flows and protect these outlets from scouring the soil. The stormwater detention basins would outfall into the off-site conveyance channels (shown as dark blue arrows along the south and east perimeter of the Project Area on Figure 2.14) or directly into a natural wash at a rate at or below the pre-development 100-year rate. Therefore, there would not be any downstream habitat or physical changes associated with rerouting surface water because the hydrology would mimic natural flow patterns.

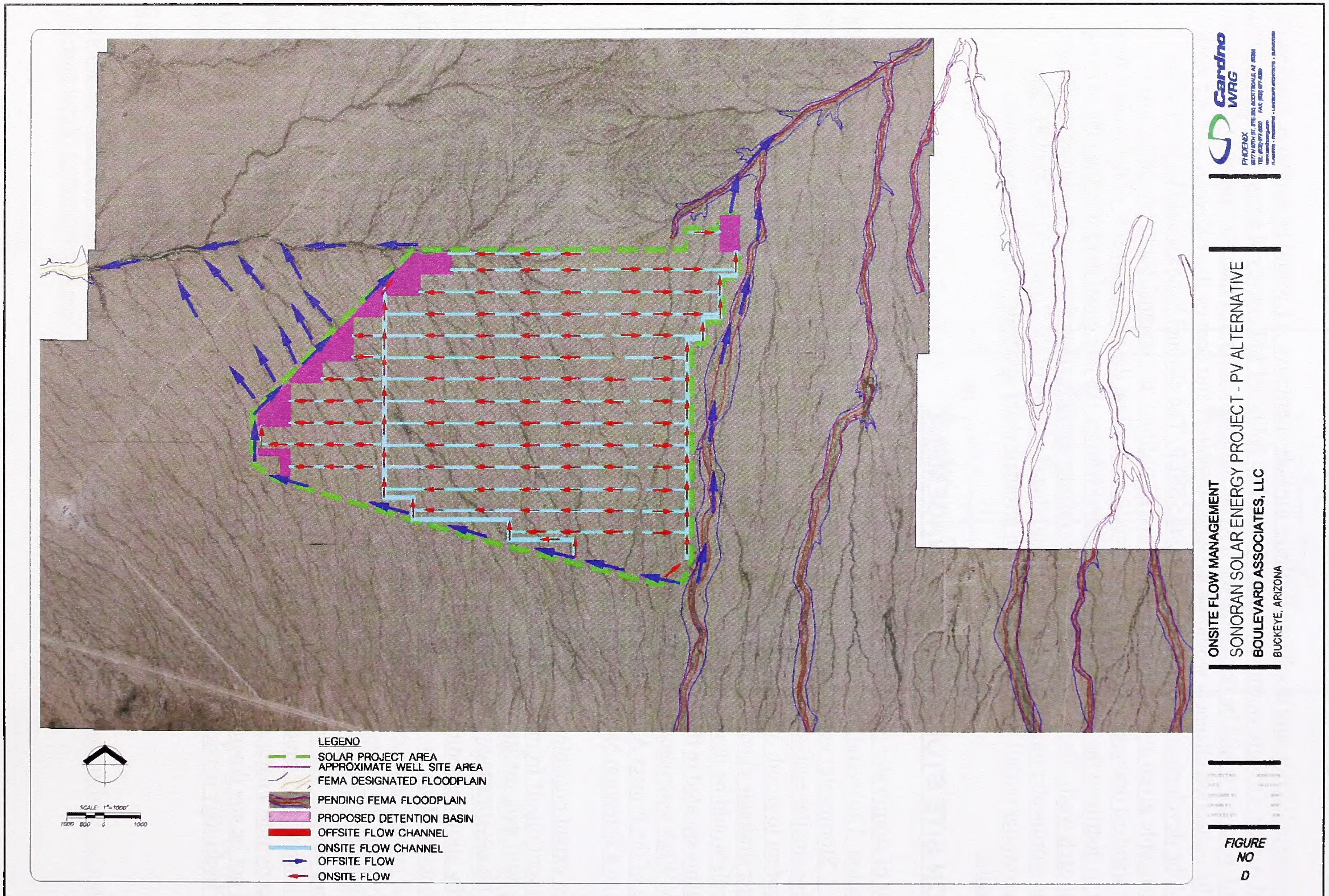

Figure 2.14 Conceptual post-construction drainage flow for Sub-alternative A1.
Note: the location and configuration of the basins in this figure are conceptual. Figure 2.12 shows a scaled configuration of the stormwater detention basins.

2.7.2.9 WELL FIELD

The groundwater production well field would be designed with up to two wells (and associated roads and pipelines) with a total capacity of 1,000–1,600 gpm (as compared to 3,000 gpm under the Proposed Action). Estimated total water demand would be 1,000 acre-feet during the 39-month construction period and 33 afy thereafter during plant operations. These wells would likely be operated individually on an as-needed basis because a PV facility does not require a continuous supply of water. The permanent water pipeline ROW would be 50 feet. All other design features would be similar to the Proposed Action.

2.7.2.10 ROADS AND ACCESS

Sub-alternative A1 access roads and transportation corridors would be the same as the Proposed Action.

2.7.2.11 PLANT AUXILIARY SYSTEMS

The following plant auxiliary systems would control, protect, and support Sub-alternative A1 and its operation.

2.7.2.11.1 Distributed Control System

The distributed control system under Sub-alternative A1 would be similar to that described for the Proposed Action.

2.7.2.11.2 Lighting System

Outdoor night lighting would be provided at the operations and maintenance building, water treatment areas, and the project substation. Some portable lighting could also be required for nighttime maintenance activities. All other lighting design features would be the same as the Proposed Action, other than having a smaller project footprint and two fewer wells.

2.7.2.11.3 Cathodic and Freeze Protection Systems

No cathodic and freeze protection systems would be used for Sub-alternative A1, because no HTF or underground metal piping would be needed.

2.7.2.12 FIRE PROTECTION

Regular project operations would have a low risk of introducing fires because of the lower temperatures compared to CST power and because most electric lines within the PV arrays would be buried, and most of the materials within the solar arrays would be noncombustible (aluminum, steel, or glass). To decrease the risk of fire, all vegetation underneath the solar modules would be managed with a BLM-approved herbicide. A pre-emergent herbicide would be applied in the spring, and spot foliar applications would be used throughout the year to limit vegetation.

During construction activities, a water truck or other portable trailer-mounted water tank would be kept on-site and available to workers for use in extinguishing small human-made fires. All vehicles working on-site would also carry a portable fire extinguisher. An emergency action plan (EAP) would designate responsibilities and actions to be taken in the event of an emergency during construction of the project. The EAP, including fire prevention and suppression, and a worker safety plan would be available to the BLM.

The fire protection systems for plant site operations could include a fire protection water system for protection of the operations and maintenance building, portable water tanks (e.g. "Buffalos"), and portable fire extinguishers. The project's fire protection water system would likely be supplied from a water storage tank located on the solar plant site near the main entrance.

Additional emergency response would be provided externally by local municipalities, if required. The proponent would develop an escape fire plan in consultation with the BLM. This plan would be approved by the BLM and become a part of the POD and authorization for the solar plant facility.

2.7.3 Construction and Operations

2.7.3.1 CONSTRUCTION AND INSTALLATION

Construction under Sub-alternative A1 would take the same amount of time as under the Proposed Action, although the construction would be staged in 100-MW-per-year increments. Initial construction activities, including mobilization, construction zone delineation, and establishment of temporary use areas, would be similar to the Proposed Action. Other construction phases would differ, however, as displayed in Table 2.12. This schedule is preliminary and could shift during project construction based on generation requirements, contractual milestones with off-takers, and emission thresholds from grading.

Table 2.12 Sub-alternative A1 Project Construction Plan

Activity	Month
Clear and grub; strip topsoil	Months 1–22
Install certified weed-free fiber rolls or silt fence at the base of slopes adjacent to delineated sensitive areas (i.e., washes), if any; Install or repair BMPs	Months 1, 11, 23, 35
Mass and finish grading	Months 1-29
Construct stormwater detention/evaporation areas	Months 1–3, 13–14, 25–26
Construct roads	Months 2–7
Construct reinforced concrete foundations	Months 7–8, 15–16, 27–28
Assemble and erect photovoltaic trackers and panels	Months 6–39
Construct gen-tie line	Months 8–12
Construct operations and maintenance building	Months 4-5
Construct substation	Months 4-7
Construct water storage tank	Months 6-7
Finish parking areas and roadways	Month 11
Commission and test	Months 11–12, 16–17, 21–22, 26–27, 31–32, 36–39

2.7.3.2 CONSTRUCTION AND OPERATIONS TRANSPORTATION NEEDS

Construction would require peak manpower of 378 people per day and an average manpower of 335 people per day. Peak daily trips to the Project Area under Sub-alternative A1 (deliveries and commuters) would total approximately 282 trips per day. Assuming approximately 30% of construction workers would carpool (on account of longer-than-normal commute times from population centers and the current price of fuel), 267 of these trips would be vehicles carrying construction workers to and from the Project Area each day during typical AM and PM peak hours. The remaining 15 trips would be truck deliveries of equipment and materials that would occur outside of the typical AM and PM peak hours. The average

daily construction travel to the Project Area would be approximately 247 trips per day (237 related to construction worker travel to and from the Project Area and 10 related to truck deliveries). The SSEP would require an operations staff of approximately 16 full-time employees, versus 82 full-time employees for the Proposed Action.

2.7.3.3 CIVIL WORKS CONSTRUCTION SEQUENCE

Temporary construction laydown, parking areas, and power source would be the same as the Proposed Action. The construction sequence for plant construction would also be similar to the Proposed Action and include site preparation, major equipment installation, and testing and commissioning. A detailed breakdown of the site's preliminary estimate of cut-and-fill volumes is provided below:

- Solar field, internal access roads, detention ponds, and diversion channels: 2,675,000 CY cut
- Solar field, internal access roads, detention ponds, and diversion channels: 2,145,000 CY fill
- Solar field, internal access roads, detention ponds, and diversion channels: 530,000 CY net cut (excess)
- Asphalt access road: 30 CY cut
- Asphalt access road: 390,000 CY fill
- Asphalt access road: 389,970 CY net fill (required)
- Project net: 530,000 CY cut – 389,970 fill = 140,030 CY cut (excess)

2.7.3.3.1 Generation Tie Line Construction Sequence

The gen-tie line construction sequence would be the same as under the Proposed Action.

2.7.3.3.2 Water Pipeline

The water pipeline would be designed to deliver groundwater pumped from the Sub-alternative A1 well-field to the main project footprint and would be completed early in the construction sequence to support other construction activities. Construction of water supply lines would take approximately three months. Pipeline design features and construction sequence would be the same as under the Proposed Action.

2.7.3.4 OPERATIONS

2.7.3.4.1 Operations Staff and Vehicles

Under Sub-alternative A1, the SSEP would be staffed by up to 16 operations personnel during the site's daytime working hours. Operations personnel would work a single shift from 7 AM to 4 PM, Monday through Friday. During time periods when the facility is not fully staffed, the facility would be monitored remotely from Boulevard's parent company's Fleet Performance and Diagnostic Center in Juno Beach, Florida. If emergency conditions are encountered, staff would be alerted and would return to the facility as required. Specialty personnel could also be located on-site during nonworking hours to perform specific maintenance functions as required. Operation and maintenance vehicles would include ¾-ton pick-up trucks and small utility vehicles to perform on-site welding, lubricating, panel washing, and other maintenance activities. In addition, flatbed trucks, dump trucks, front-end loaders may be present on-site at various times. Heavy-haul transport equipment would be brought on-site as needed for any major maintenance or equipment repair or replacement.

2.7.3.4.2 Operation and Maintenance Activities

Sub-alternative A1 facilities would be repainted on a regular basis to maintain their appearance and protect them from the elements. The PV panels would be washed approximately four times per year to increase the average optical transmittance of the flat panel surface. Panel washes would likely occur during off-peak hours. The demand for water to wash the panels is approximately 45,000 gpd. All other operation and maintenance activities would be similar to the Proposed Action.

2.7.4 Water Use and Waste Treatment

2.7.4.1 WATER TREATMENT AND USE

2.7.4.1.1 Water Requirements

Construction

During site preparation and grading activities, the main use of water would be for compaction and dust control. Smaller quantities would be required for preparation of the concrete required for foundations and other minor uses. Subsequent to the earthwork activities, water usage would provide dust suppression and normal water requirements that are associated with construction of the building, substation, internal access roads, and solar arrays.

The total water usage during construction would be approximately 1,000 acre-feet over a 39-month period. The total water usage during construction of the first 100 MW (Phase I) is estimated to be approximately 450 acre-feet. The water demand for Phase II and III construction should be reduced because most of the shared facilities and common infrastructure would have been installed as part of Phase I.

Operations

During operations, water use would be limited primarily to PV array washing with the potential for periodic dust control applications. The internal access roads would not be heavily traveled during normal operations, and a BLM-approved dust suppressant would be applied to control dust. Water could be used to supplement the dust suppressant in some areas on a limited basis.

The amount of water required to clean the PV modules four times per year is estimated to be approximately 10.5 million gpy (approximately 32 afy). Depending on site events and conditions, however, the cleaning frequency could be less. The water used for module cleaning would not require disposal due to the extremely high evaporation rate at the site.

Drinking (potable) water would also be supplied for workers on-site and is estimated to be approximately 10,000 gpm (approximately 0.5 afy), varying seasonally and by work activities. The potable water would be brought to the site by either tanker truck or via groundwater, using a water treatment system to treat the water to meet potable standards.

2.7.4.1.2 Water Treatment

All of the SSEP's nonpotable water needs under Sub-alternative A1 would be supplied from groundwater, which would require on-site treatment to ensure the necessary water quality for project activities.

The panel washing water would require an on-site demineralizer treatment process prior to use. A water treatment plan would be developed based on receipt of additional site-specific water quality data. However, the on-site demineralized water tank would have a capacity of 8 acre-feet, which is the approximate water usage for one wash of the entire project's PV panels.

On-site tanks would store the raw water, treated water, and potable water. Water storage tank volumes would total approximately 2,600,000 gallons and each would measure 50 feet tall and 100 feet in diameter.

2.7.4.2 WASTE MANAGEMENT

Project wastes would be similar to the Proposed Action. A variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials. Plant personnel would be supplied with appropriate PPE and would be properly trained in the use of PPE and the handling, use, and cleanup of hazardous materials used at the facility, as well as procedures to be followed in the event of a leak or spill. Adequate supplies of appropriate cleanup materials would be stored on-site.

2.7.4.2.1 Wastewater

There would be two separate wastewater collection systems: one for the sanitary wastes and a second system to address the process wastewater for panel washing. Wastewater collection and disposal for the sanitary wastewater system would be similar to the Proposed Action. A trailer-mounted water treatment system would be used for panel washing. A small (approximately 1-acre) evaporation pond would be required for the RO reject water, whereas the demineralizer's spent resin could be transported off-site for regeneration.

2.7.4.2.2 Solid and Non-hazardous Waste

Generation and management of solid and nonhazardous wastes would be the same as under the Proposed Action.

2.7.4.2.3 Hazardous Solid and Liquid Wastes

Generation and management of hazardous solid and liquid wastes would be the same as under the Proposed Action.

2.7.5 *Termination and Reclamation*

Sub-alternative A1 would have a useful life of at least 20–25 years. All other termination and reclamation actions would be the same as under the Proposed Action.

2.7.6 *Disturbance Assumptions*

The estimated disturbance dimensions for construction and operation components of Sub-alternative A1 would be the same as described in Section 2.5.6 under the Proposed Action, except that no gas lines would be constructed.

2.8 Alternative B: Reduced Footprint

2.8.1 Introduction

Alternative B was developed to respond to issues identified during agency and public scoping, including impacts to wildlife linkages and travel corridors, impacts to residential areas, impacts to xeroriparian vegetation and washes, impacts to water use, and the overall level of surface disturbance resulting from the SSEP. Under Alternative B, the SSEP would consist of two independent, concentrated solar electric generating facilities, each with nominal net electrical outputs of 125 MW (for a total of 250 MW), rather than 375 MW considered under the Proposed Action. The reduction of generating capacity would allow a reduced project footprint and the avoidance of the eastern-most wash in the Project Area and an associated pond, which agency scoping identified as a wildlife habitat feature.

The main project footprint (not including linear features such as roads, pipelines, or transmission lines) under Alternative B would occupy approximately 2,136 acres, or 63% of the footprint under the Proposed Action (Map 6). Alternative B would require approximately 1,518–2,003 acre-feet of water per year for operations, which would be supplied by three groundwater wells in the same area as under the other action alternatives. Total solar generation would be approximately 33% less than the anticipated generation under the Proposed Action. Based on publicly available sources (LAZARD 2008, SEIA 2010, WorleyParsons Group 2008), the estimated capital cost of the Alternative B facility would be between $1.1 and $1.6 billion (see Table 2.15). This cost includes capitalized interest costs during construction, operation and maintenance costs, and fuel prices.

In general, most aspects of Alternative B would be the same as under the Proposed Action. As such, only those subsections and details that would differ substantively from the Proposed Action are discussed below under Alternative B. The alternatives are quantitatively compared in Section 2.12, Table 2.15.

2.8.2 Proposed Facilities and Infrastructure

Under Alternative B, the SSEP facilities and infrastructure would be scaled to two 125-MW facilities, rather than one 125-MW and one 250-MW facility as under the Proposed Action.

2.8.2.1 POWER BLOCK AND CO-FIRING BOILERS/HTF HEATERS

Under Alternative B, two co-firing boilers, one for each 125-MW unit, would be constructed. They would each have the same output as each of the boilers (three) under the Proposed Action.

Under Alternative B, the SSEP would use 33% less natural gas than under the Proposed Action, for an annual natural gas usage of approximately 2,600 million standard cubic feet per year or a maximum of 2,655,000 MMBtu per year.

2.8.2.2 ANCILLARY FACILITIES

The total square footage of the various SSEP buildings and pre-engineered enclosures (e.g., control rooms, administration building, warehouse, electrical equipment enclosures, fire pumps, and diesel generators) would be approximately 22,000 square feet for each 125-MW unit (the Proposed Action would use approximately 38,000 square feet for the 250-MW unit and 22,000 square feet for the 125-MW unit, for a difference of approximately 16,000 square feet less than the Proposed Action).

2.8.2.3 WELL FIELD

The groundwater production well field would be designed with three wells (and associated roads and pipelines) with a total a capacity of 2,000 gpm (as compared to 3,000 gpm under the Proposed Action).

2.8.2.4 EVAPORATION PONDS

Each 125-MW unit would have three 10-acre, double-lined evaporation ponds (60 acres total for both units). This is 30 fewer acres than under the Proposed Action.

2.8.2.5 LAND-TREATMENT UNIT

The SSEP would be constructed with two 5-acre, land-treatment units (compared to a total of 15 acres under the Proposed Action).

2.8.3 Construction and Operations

Construction of each unit under Alternative B would take approximately 25 to 28 months, with a total construction period of approximately 37 months (2 months less than under the Proposed Action). Because the second unit constructed under Alternative B would have a 125-MW capacity, rather than the 250 MW described under the Proposed Action, the construction schedule for the second unit would be shortened. In particular, the following construction phases for the second unit would be shorter under Alternative B than under the Proposed Action (as shown for the Proposed Action in Table 2.5).

- Assemble and erect parabolic troughs: Months 12–24
- Construct power block: Months 13–31
- Construct reinforced concrete foundations: Months 12–18
- Commissioning and testing: Months 33–37

Construction would require peak manpower of 1,350 people per day and an average manpower of 750 people per day. Peak daily trips to the SSEP site under Alternative B (deliveries and commuters) would total approximately 950 trips per day, assuming a 70% carpool factor. The average daily construction travel to the site would be approximately 600 trips per day.

Under Alternative B, the SSEP would require an operations staff of approximately 70 full-time employees, versus 82 full-time employees for the Proposed Action.

2.8.4 Water Use and Waste Management

2.8.4.1 WATER REQUIREMENTS

Under Alternative B, the same cooling method would be used as under the Proposed Action. However, water usage would be reduced along with the size of the solar field and the capacity of the steam turbine generators. The estimated water use under Alternative B is shown in Table 2.13.

Table 2.13 Typical Water Usage Estimate – Alternative B

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	5.5	10.2	2,003
Minimum (assumes solar production only)	4.2	7.8	1,518

[1] The estimate of groundwater usage is based on an average daily consumption rate for two 125-MW power plants.
[2] The peak rate is the instantaneous maximum for summer usage for two 125-MW power plants.

2.8.4.2 WATER TREATMENT

Treated water storage tanks would reflect the requirements for two 125-MW units (rather than one 125-MW unit and one 250-MW unit):

- Raw water/fire water storage tank: 2 × 125-MW units: 2×500,000 gallons
- RO feedwater storage tank: 2 × 125-MW units: 2 x 100,000 gallons
- Demineralized water storage tank: 2 × 125-MW units: 2×75,000 gallons

2.8.5 Termination and Reclamation

The methods, timing, and requirements for termination and reclamation would be the same under Alternative B as under the Proposed Action. Because of differences in the design and layout of the solar field and well field, different acreages would be reclaimed on termination of the SSEP.

2.9 Reduced Water Use Option: Brine Concentrator

An optional component, a brine concentrator, could be added to either of the action alternatives that would use a wet-cooling system (the Proposed Action and Alternative B); its effects are considered under each of these alternatives in Chapter 4. The water treatment design under the Proposed Action and Alternative B includes pre-treatment and post-treatment systems, which would consist of multimedia filters and a two-pass RO system. A brine concentrator is a piece of equipment that can be added to the post-treatment system. The brine concentrator is fed by the osmosis reject (concentrate) stream from the second pass osmosis train. A steam or electric heat source evaporates the pure water from this salty concentrate, which serves to increase the brine concentration of the remaining liquid. The additional heat requirement for this piece of equipment would result in a slight decrease in the SSEP's electrical output. The brine is recirculated until the salts reach their solubility limits. When the brine reaches this limit, a blowdown valve would open and dump the concentrated brine solution to the evaporation ponds. The pure water evaporated during this concentration process is condensed by a heat exchanger and recycled back to the cooling tower. The brine concentrator would be located in the power block area.

The use of a brine concentrator would reduce the volume of wastewater exiting the facility. Its use would also allow a reduction in evaporation pond sizes, and a reduction in plant water consumption. In general, the capital and operating costs of the brine concentrator exceed the costs of installing and operating larger evaporation ponds. The water savings from this type of system under the wet-cooled alternatives (the Proposed Action and Alternative B) would be approximately 7% or less (see Figure 2.16). The largest water consumers in a wet-cooled facility are the cooling towers, where a great deal of water is evaporated (greater than 85% of a plant's use). The use of a brine concentrator would have no effect on the evaporation rates in the cooling towers.

2.10 Generation Tie Line Option

As part of the Arizona Corporation Commission CEC process (see Section 1.6.3 for a description), Boulevard has developed an alternate gen-tie line alignment, which could be applied to any of the action alternatives. Because this optional route would meet the purpose and need for the project and could feasibly be implemented, BLM is considering it in this final EIS as an alternative (or optional) means of routing produced electricity from the SSEP solar field to the Jojoba Switchyard. This option would address alternate methods and locations for crossing existing high-voltage transmission lines near the project, as well as an alternate route through existing designated utility corridors that may be subject to future development.

The Gen-tie Line Option would be routed in a generally southwestern direction and would use an existing utility corridor, as described in Section 2.5.2.5.3. The Gen-tie Line Option would be initially routed directly south along a new road and then make a 90 degree turn to the west, also along a new road. It would then extend westward to the Jojoba Switchyard, as shown on Map 3, for a total of 3.4 miles under the Proposed Action. This represents an increase of approximately 13% as compared to the original gen-tie alignment (see Table 2.15). There would also be approximately 10 pulling sites (as compared to six in the original alignment) required to install the conductors.

A supplemental EIS was not prepared because no supplemental documentation is needed for the BLM to make a reasoned decision between alternatives to the proposed federal action. The Gen-tie Line Option would result in impacts of the same nature, to the same resources, and of the same approximate extent (within 1%) as those considered in the draft EIS, and it would not result in any unique site-specific impacts not considered in the draft EIS.

2.11 Alternatives Considered but Eliminated from Detailed Analysis

Several alternatives were considered during the EIS process but eliminated from detailed analysis. In general, the following reasons may be considered grounds for eliminating an alternative (BLM Handbook H-1790-1, 6.6.3):

- It is ineffective (it would not respond to the purpose and need).
- It is technically or economically infeasible.
- It is inconsistent with the basic policy objectives for the management of the area.
- Its implementation is remote or speculative.
- It is substantially similar in design to an alternative that is analyzed.
- It would have substantially similar effects to an alternative that is analyzed.

The specific alternatives that were eliminated from detailed analysis are discussed below, along with the rationale for their elimination.

2.11.1 Original Application/Larger Project

Boulevard originally filed an SF-299 application with the BLM's Lower Sonoran Field Office (LSFO) in June 2007. In October 2008, at the request of the BLM, Boulevard submitted a preliminary POD. Based primarily on the size and topography of the proposed project site and with limited field reconnaissance, the initial POD proposed a 500-MW solar facility consisting of two separate, 250-MW generating stations.

As proposed, the 500-MW site would have encroached on two significant (1-mile wide) utility corridors; one in the southern portion of the layout and the other on the northwest side of the site. As such, a Resource Plan Amendment would have been required to develop the SSEP as a 500-MW facility, as originally proposed. Additionally, constricting these corridors would pose significant challenges to the local utility providers and to the BLM, and the plan amendment process would add months to an already tight permitting schedule. As such, the original configuration was eliminated as an alternative to avoid encroachment into the utility corridors.

Early in the biotic and abiotic field reconnaissance process, Boulevard field crews noted the relatively large drainage features that traverse the northern portion of the requested ROW. Specifically, Rainbow Wash and an unnamed tributary to Waterman Wash are oriented in a generally east to west direction across the northern one third of the site, effectively creating a natural boundary. Rather than moving forward with an alternative that would require re-routing these natural drainage features to accommodate the facility footprint, Boulevard voluntarily elected instead to use these washes as a northern boundary and design the facility in such a way as to avoid any impacts to the washes and their associated xeroriparian vegetation.

In order to avoid the utility corridors to the south and north-west and the primary washes to the north, the original proposal was eliminated from further analysis. As a result, Boulevard reduced its design goals for the site and reduced the overall facility size from the originally proposed 500 MW, to a more compact 375-MW design.

2.11.2 Hybrid Cooling

In a hybrid cooling scenario, the wet cooling and dry-cooling technologies described under the Proposed Action and Alternative A would be combined and used in tandem. This combined system would result in partially reduced water use and a lower electrical generation penalty than would be seen with the use of the fully dry-cooled system in Alternative A. A hybrid cooling system essentially requires the construction and operation of both a dry-cooling system and a wet-cooling system in a single plant, as described below in Section 2.11.2.1. This would result in a higher capital expenditure to purchase and construct both systems and a higher cost over the life of the project to operate both systems. A hybrid system does not achieve the same level of water savings as a dry-cooled system for the associated costs. Because of the hybrid system's increased cost and because it would not provide environmental benefits comparable to a dry-cooled system (considered under Alternative A), this alternative has not been carried forward for detailed analysis.

2.11.2.1 TECHNOLOGY AND PRINCIPLES OF OPERATION

In a hybrid-cooled facility, the cooling duty-cycle for the wet and dry-cooling systems can be designed in almost any ratio. In a performance (electrical production) optimized hybrid cooled system, dry cooling would be used when performance penalties are lowest (winter months), and wet cooling would be used when ambient temperature is the highest (summer months). Ideally, each cooling system would be designed to handle the full cooling duty load for the power plant in its respective generation period, which means that a full-sized wet and a nearly full-sized dry-cooling system would be required. In this case, given that the SSEP would produce the highest output in the summer months when solar resource is the highest, the optimally designed hybrid application would require a wet-cooling system essentially identical to the wet-cooled Proposed Action. In the cooler winter months when generation is lowest and environmental conditions make most sense for dry cooling, a smaller dry-cooling system would be required than what was discussed in Alternative A (dry cooling). Because winter electrical generation is lower, the system would be sized to accommodate the cooling requirements during the low solar conditions.

Such a design and operational philosophy works extremely well in high capacity factor, combined-cycle generating facilities, especially in moderate climates and this approach can yield significant water savings.

In a hot, desert environment where a facility operates primarily during the day when temperatures are the highest (i.e., the Proposed Action), the benefits described above begin to erode. Assuming an optimal configuration, the dry-cooling system would operate at the SSEP during the winter months when the ambient temperatures and solar insolation are the lowest, and where impacts from a loss of turbine efficiency would be the least. This time period also coincides with the months when the smallest amount of solar generation is possible. During the summer months when temperatures and solar generation potential are at their peak, the SSEP would be primarily wet-cooled. Because most of the solar plant's water use and generation occurs during the summer, the plant would be using primarily wet-cooling during the period when water consumption is the greatest.

2.11.2.2 WATER CONSUMPTION COMPARISON

In a hybrid facility, water consumption figures would fall somewhere between a wet- and dry-cooled plant and be completely dependent on how the two cooling systems were sized and their operating schedule. In a preliminary analysis, Boulevard evaluated a system with equally sized wet and dry systems. The systems were sufficiently sized to operate entirely wet at full capacity in the summer and entirely dry at full capacity in the winter. This configuration results in a 27% reduction in water use compared with the Proposed Action and water savings occur almost exclusively during winter months. Generation losses resulting from the decrease in turbine efficiency associated with the use of the hybrid system were calculated at roughly 66% of the losses that would be experienced under Alternative A (or a 6% loss compared to the Proposed Action). In summary, a hybrid system would sacrifice significant electrical generation and absorb a large increase in capital costs to realize a comparatively small savings in water consumption. The costs and impacts to the price of electricity would be similar to the dry-cooled system discussed as Alternative A.

2.11.2.3 COMPARISON OF COSTS

The total capital costs of a hybrid project change in proportion to the cooling duty ratio and would depend on the sizing of the wet and dry components. The largest cost driver is generally the wet-cooling system and treatment costs required to operate the plant during the peak summer months. This equipment (water treatment systems, cooling towers, evaporation ponds, etc.) would be sized nearly identically to the Proposed Action. Additionally, a hybrid project would also bear the cost of the dry-cooled components described in Alternative A (ACC). A hybrid-cooled plant designed in an optimal fashion begins to mimic the costs of a dry-cooled plant.

The costs of a hybrid system mimic a dry-cooled system because when the costs of these two different cooling systems are combined, the resulting cost is very similar (if not higher) than a stand-alone dry-cooled project. However, only marginal water savings result because most of the water demand results from the operation of the wet-cooling system during the summer when electrical generation and water usage is highest. To significantly reduce water consumption in a hybrid-cooled plant, a larger ACC (and the increased capital costs and lower electrical generation) is required to assume cooling duties during periods other than the low-solar resource winter months. To maximize generation during the peak summer months, the plant would still require a full-sized wet-cooling system. As the size of the dry-cooling system continues to increase, the capital costs eventually become higher than a stand-alone dry-cooled system without any of the environmental benefits (reduced water use). In this case, the dry-cooled plant makes more sense from both economic and environmental perspectives.

This same principle holds true for impacts to generation. The more often the dry-cooling system is used, the more significant the impacts are to annual generation. In a hybrid facility optimized for a desert environment, the impacts to generation are only a few percentage points below the impacts in a dry-cooled facility. Again, a hybrid facility's generation profile begins to mimic that of a dry-cooled facility.

In summary, although a hybrid-cooling alternative is a technically viable option, it would be inefficient and expensive relative to other alternatives carried forward for analysis. A hybrid design would require the capital and operational expenses of both wet and dry-cooled systems and this facility would be impacted by annual generation losses. In a hot, desert environment, this type of cooling technology does not provide the water savings that might be realized in a moderate climate. In summary, the environmental benefits (water savings) of a hybrid facility would be less substantial than the benefits for a dry-cooled facility, even though the costs would be similar. A hybrid facility would be significantly more expensive than the Proposed Action and this cost would ultimately be passed on to the Arizona rate-payer.

2.11.3 Utility-scale Photovoltaic Energy Production (draft EIS only)

PV technology was eliminated from further analysis in the draft EIS because at that time, it would not have provided the level of dispatchable renewable energy that Arizona utilities were seeking. In addition, large-scale PV facilities on the scale of the Proposed Action had not yet been constructed anywhere in the world, and the advantages and challenges of such a facility had not been quantifiably studied, analyzed, or understood. However, advancements in technology and a change in market conditions have allowed a reconsideration of PV technology in the final EIS. It is considered in detail as Sub-alternative A1 (see Section 2.7).

2.11.4 Residential (Rooftop) Photovoltaic Energy Production and Energy Conservation

During scoping several commenters suggested the consideration of residential, rooftop, or distributed energy production, as well as the consideration of combining such distributed generation with increased energy efficiency. The use of distributed generation and/or energy conservation is beyond the scope of this EIS and is therefore not considered for detailed analysis. Distributed generation and energy conservation would not provide a response to the ROW application submitted by Boulevard for the SSEP because Boulevard and the BLM have no discretion or decision-making power regarding the use and implementation of distributed generation and energy conservation in private homes or commercial buildings. Decisions related to residential rooftop, or distributed energy production reside with the private homeowner, commercial building owner, and other entities (e.g., local, county, and state governments) because these entities control the use of their rooftop and other surfaces for potential energy production. Likewise, although the implementation of energy conservation measures would reduce the demand for all forms of energy regardless of the method of energy production, decisions with regard to energy conservation measures reside outside the authority of the BLM and Boulevard. The BLM's decision with respect to Boulevard's ROW application has no bearing on these private entities' decisions.

2.11.5 Alternative Solar Technologies

Alternative solar technologies, including Stirling engines and power towers, were considered during the alternatives development stage, but they were eliminated from further consideration because these technologies have not been commercially proven on a utility scale. To date, nearly all Stirling engine and power tower projects have been deployed on a pilot scale and funded by the technology developers. In order to ensure project financing, Boulevard's development efforts are focused on technologies with proven track records and successful operating histories.

2.11.6 Alternate Locations

In addition to the ROW application for the SSEP, Boulevard has submitted applications for five other BLM locations and assessed the potential for solar development on a number of private land locations. Boulevard's applications on BLM land were for sites that proved suitable for solar development based on a number of exclusion criteria Boulevard used to screen for, identify, and prioritize other land sites (both privately owned and BLM-administered) for future solar development. Some of these exclusion criteria were as follows:

- Solar indices less than 7.0 kWh per square meter per day. Higher solar indices translate to greater energy output per unit area. Screening sites based on this criterion means fewer acres of disturbance per kWh of energy production.
- Wilderness, wilderness study areas (WSA), areas of critical environmental concern (ACEC), parks, and military installations. These areas were avoided to avoid or minimize impacts to sensitive resources. However, "no development" buffer zones are generally not applied to Wilderness, WSAs, ACECs, parks, and military installations. Therefore, although potential sites were screened based on this criterion, a project adjacent to one of these areas is not reason by itself to preclude a proposal. In the case of the proposed SSEP location, the nearby monument is already adjacent to an occupied 1-mile-wide BLM-designated utility corridor, which would fall between the SSEP and the monument.
- Special-status species habitat conservation areas. These areas were avoided to minimize impacts to sensitive biological resources.
- Slope greater than 3%. Flatter slopes decrease cut/fill requirements and associated dust emissions and habitat loss and are easier to build on with lower costs.
- Floodplains. Sites were screened based on the presence of floodplains to avoid or minimize flood-related risks to project facilities, reduce the extent of drainage control structures needed, and minimize potential downstream impacts to habitat.
- Populated areas. Populated areas were avoided as much as possible to minimize noise and visual impacts to property owners.
- Land greater than 20 miles from major transmission and natural gas pipelines. Close proximity to existing transmission and gas pipelines minimizes acres of disturbance while at the same time reducing fixed project costs.

After identifying target areas, Boulevard identified and visited potential sites to confirm the following additional feasibility criteria:

- Size (minimum 1,600 acres)
- Available for sale or lease

The purpose of Boulevard's screening process was to identify and avoid areas with the greatest potential for adverse impacts or permitting issues and to focus instead on areas that would avoid as many land-use issues, visual and environmental impacts, and implementation challenges as possible. Boulevard also attempted to locate the SSEP near existing infrastructure to minimize the need for additional disturbance from roads, gas pipelines, and transmission lines and to reduce fixed project costs. By applying these criteria, significant portions of the State of Arizona were eliminated from further consideration by Boulevard.

At the conclusion of the screening process, the currently proposed SSEP location emerged as the best site for Boulevard to begin the permitting and environmental documentation process for a number of reasons, most notably its close proximity to transmission and natural gas infrastructure, potential for groundwater development, and the few anticipated environmental impacts.

In the draft EIS, the BLM eliminated from detailed consideration other locations on BLM (Section 2.11.6.1) and private lands (Sections 2.11.6.2 and 2.11.6.3) as alternatives to the SSEP location. The rationale, as presented in the draft EIS, for eliminating these locations from detailed analysis has been retained in this final EIS (with modifications based on public comments on the draft EIS). At the time the draft EIS was produced, the use of PV technology was not a viable alternative to CST technology. Many of the reasons for eliminating other locations from detailed analysis had to do with the operational requirements of CST technology, such as the use of natural gas for freeze protection and the use of water for cooling. Because PV technology is now a viable alternative to CST technology, many of the factors that contributed to eliminating other locations for detailed analysis under CST (necessary pipeline distances, etc.) would not apply to a PV project. Therefore, locations that were considered but eliminated from detailed analysis in the draft EIS may be viable locations (technically and economically) for a project using PV technology.

However, BLM has issued additional policy guidance in BLM IM 2011-059 since the publication of the draft EIS that further supports the elimination of alternative locations from detailed analysis. BLM IM No. 2011-059 provides guidance that BLM 1) may decide not to consider sites with active ROW applications as alternatives in a NEPA process for other ROW applications and 2) typically will not "analyze a non-federal land alternative for a right-of-way application on public lands because such an alternative does not respond to the BLM's purpose and need to consider an application for the authorized use of public lands for renewable energy development." Because the alternative BLM locations discussed below are not locations suggested during scoping but are separate and distinct ROW applications, they are not considered as potential alternatives in the NEPA process for this ROW application. Likewise, alternative private land locations are not considered further by the BLM because they would not meet the BLM's purpose and need.

Additional reasons why alternative BLM and private land locations are not considered in detail in this final EIS consist of the following:

- No additional suitable BLM sites were suggested during scoping or during the public comment process on the draft EIS.
- The consideration of alternative locations was not necessary because the BLM was able to develop a range of alternatives responsive to identified resource conflicts at the proposed SSEP location by varying the size and design of the facility.
- Alternate locations for solar development on BLM lands are currently being considered in the *Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (BLM and DOE 2010).

2.11.6.1 ALTERNATIVE BLM LOCATIONS

Using the site screening criteria described above, Boulevard identified six potential project locations (including the Proposed Action) within Arizona on BLM lands. As noted above, of these six locations the proposed site was superior although each of the remaining five sites has the potential for future development given an adequate permitting timeline. However, at the conclusion of the screening process described above, the SSEP site emerged as the most suitable to allow the completion of permitting in a timely fashion. ROW applications are still pending for each of these sites, with the exception of the Senator location. The other locations eliminated from consideration in this EIS are described in Table 2.14.

These sites were not considered as alternatives to the SSEP site for three primary reasons, as explained in more detail above. First, they are not locations suggested during agency and public scoping. No additional suitable BLM sites were suggested during scoping. Second, IM 2011-059 provides the BLM with

guidance that they may decide not to consider sites with active ROW applications as alternatives in NEPA processes for other ROW applications. Third, even if these sites were potential alternatives in the NEPA process for this ROW application, their consideration was not necessary for the BLM to develop a reasonable range of alternatives that address the resource conflicts identified in public and agency scoping.

Table 2.14 Alternative BLM Sites Considered

Site	General Description/Location
Aguila	BLM property located in northwestern Maricopa County, Arizona, approximately 3 miles south of the Town of Aguila, between the Harquahala and Vulture mountains
Burnt Mountain	BLM property located in western Maricopa County, Arizona, approximately 15 miles west of Tonopah, Arizona, and just north of Interstate 10, near the southern end of the Big Horn Mountains
Bouse	BLM property located in La Paz County, Arizona, on the western slope of the Plomosa Mountains within the La Posa Plain, approximately 16 miles north of Quartzsite, Arizona and 4 miles west of Bouse, Arizona
Mountain Spring	BLM property located in the western portion of Mohave County, Arizona, approximately 38 miles northwest of Kingman, and just southwest of Arizona Highway 93 at the eastern base of the Black Mountains
Senator	BLM property located in central Mohave County, Arizona, approximately 47 miles northwest of the Town of Kingman, and 3 miles east of Arizona Highway 93

The primary reasons for originally eliminating each of the five alternative sites are discussed below.

2.11.6.1.1 Aguila

The Aguila site was eliminated from further consideration primarily because of transmission and natural gas line constraints. Although there are high-voltage transmission lines adjacent to the Aguila site, there is currently not sufficient capacity on the lines to meet the needs of the project. The site would also require a gas pipeline at least 20 miles in length, which would create significant additional habitat disturbance, and add costs to secure easements. The uncertain availability and difficulty in acquiring groundwater or surface water rights also present challenges. Finally, the site's proximity to residences and a wilderness area were also considered. Development of this site is possible, but is not consistent with the SSEP's proposed timeline.

2.11.6.1.2 Burnt Mountain

The Burnt Mountain site was eliminated from further consideration because of its proximity to a wilderness area and its encroachment into a BLM-designated utility corridor. Construction of a power plant within this corridor would require a BLM plan amendment and additional notice and review time in the EIS process, extending the timeline beyond the desired December 2010 completion date. Development within this utility corridor would also constrain future transmission line development. Acquisition of sufficient water rights in a timely fashion also presents significant challenges.

2.11.6.1.3 Bouse

The Bouse site was eliminated from further consideration primarily because it would require a transmission line at least 29 miles in length and a gas pipeline over 13 miles in length. Although there are transmission lines adjacent to the Bouse site, there is currently not sufficient capacity on the lines to meet the needs of the project. The length of these linear facilities would require a significant investment of time and money to secure the required easements and these factors are not consistent with the goals of the SSEP. The Bouse site may also present various land-use, biological species, and water use challenges.

2.11.6.1.4 Mountain Spring

The Mountain Spring site was eliminated from further consideration due to insufficiencies in the quality and quantity of groundwater available at the site, and the uncertainty of acquiring surface water in a timely fashion. The site is also extremely remote from existing gas pipelines and would require the construction of a 38-mile pipeline to support the needs of the project. This distance would present significant timeline and budget challenges and create a comparatively larger amount of environmental disturbance compared with the SSEP. Although transmission is available in this area, delivery to a major load center would be challenging. The site is also within the Black Mountain Wild Horse and Burro Herd Management Area and development here has the potential to impact sensitive biological species.

2.11.6.1.5 Senator

The Senator site was eliminated from further consideration due to insufficiencies in the quality and quantity of groundwater available at the site, and the uncertainty of acquiring surface water in a timely fashion. The site is also extremely remote from existing gas pipelines and would require the construction of a 54-mile pipeline to support the needs of the project. This distance would present significant timeline and budget challenges and create a comparatively larger amount of environmental disturbance compared with the SSEP. Transmission in this area is available, but delivery to a major load center would be challenging. There are also approximately 36 active mining claims in the vicinity of this site.

2.11.6.2 ALTERNATIVE PRIVATE LAND LOCATIONS

Per BLM IM No. 2011-059, BLM policy is to "not typically analyze a non-federal land alternative for a right-of-way application on public lands because such an alternative does not respond to the BLM's purpose and need to consider an application for the authorized use of public lands for renewable energy development."

Although the BLM cannot require companies to construct on private lands, Boulevard did evaluate a number of privately owned properties as potential locations for the SSEP. When screening for private sites, Boulevard used screening criteria similar to those used to identify suitable BLM sites. However, because the purpose of this screen was to identify potential alternatives to the SSEP Project Area, the private site would need to meet additional criteria to accommodate the design assumptions of the SSEP. The additional criteria included:

- Comparable distance to both the Jojoba Switchyard and natural gas pipelines to minimize additional disturbance (fewer than 15 miles)
- Appropriately sized and shaped to support design and construction of a 375-MW CST facility
- Viable options for a physically and legally available water supply
- Zoned to allow for industrial development
- Reasonably priced
- Reasonable number of parcels/land owners

Boulevard explored two areas for potentially suitable, private properties on which to develop a solar facility, east and southwest of the proposed location.

2.11.6.2.1 Southwest of the Proposed SSEP Site

Boulevard evaluated a number of privately owned properties southwest of the Jojoba Switchyard and west of State Route 85. An area of farmland was the closest grouping of private property that was potentially available for purchase, since the city of Phoenix acquired a large amount of land for its landfill and there are other facilities located in the area. This area was eliminated from consideration because the length of gas and transmission lines would be significantly increased, and would require easements and rights of way to cross Arizona State Land, other privately owned land, and SR-85. A significant portion of this area also lies within 100 year floodplains of either the Gila River or Rainbow Wash. Finally, various complexities in Arizona water law and varied property restrictions present significant challenges and uncertainties in the acquisition of long-term access to a water supply.

2.11.6.2.2 East of the Proposed SSEP Site

Boulevard also evaluated private properties to the east of the SSEP BLM site. The majority of land parcels in this area are smaller than what would be required to construct a 375-MW CST plant, which would necessitate a considerable assemblage effort. This effort would require numerous, separate land owners to sell their land at competitive prices and could take a great deal of time to accomplish even if all landowners were willing to sell. This constraint renders the SSEP's proposed timeline untenable. Additionally, ancillary facilities (gas and transmission) would need to cover a significant amount of additional distance and would still require rights-of-way across BLM land in addition to the other easements across private and/or state lands to reach the points of interconnection. Traffic volumes in the area would also increase significantly and the existing road network could have issues in accommodating this increase. The combination of these factors dictated that this area be eliminated from further consideration.

2.11.6.3 BROWNFIELD LOCATIONS

"Brownfields" are real property. Their expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. During the land screening process for the SSEP, Boulevard identified a single brownfield site in the Tucson, Arizona area for potential development. The site's location severely limited potential transmission solutions and was not sized or sloped appropriately to accommodate the SSEP's design considerations. Because development on a brownfield site did not meet the design considerations of the project and did not address other environmental considerations, this alternative was not carried forward for additional analysis.

2.11.7 Alternative Water Sources

The use of water by the SSEP under any alternative would be required to comply with all applicable state laws and regulations, including the ADWR Third Management Plan: Industrial User Conservation Requirements. In order to ensure compliance with these requirements and also to complete a comprehensive due diligence review, Boulevard evaluated a wide array of potential water supply options that could potentially meet the water supply demands of the SSEP and considered their advantages and disadvantages. The consideration of each of these options and the reason that each was ultimately eliminated from detailed analysis are discussed below:

- Off-site Groundwater within the Rainbow Valley Sub-basin
- Off-site Groundwater within the West Salt River Sub-basin
- Reclaimed Water

- Industrial Waste Water
- Surface Water
- Central Arizona Project (CAP) Water

2.11.7.1 OFF-SITE GROUNDWATER WITHIN THE RAINBOW VALLEY SUB-BASIN

Off-site groundwater withdrawals could be legally authorized through a GIU Permit or through purchase of existing grandfathered groundwater withdrawal rights including Type 1 Non-Irrigation Grandfathered Rights (Type 1 Rights), Irrigation Grandfathered Rights (IGRs) eligible for retirement to Type 1 Rights, or Type 2 Non-Irrigation Grandfathered Rights (Type 2 Rights).

2.11.7.1.1 GIU Permit for Off-site Withdrawal

Under this alternative, groundwater would be withdrawn from wells located in the same groundwater sub-basin as under the Proposed Action, but would require additional pipeline installation, pumping infrastructure, and energy consumption to deliver the water to the plant's power blocks. Consequently, when evaluating the environmental impacts to the sub-basin in terms of water use and land disturbance, this alternative would increase environmental impacts to the sub-basin when compared to the Proposed Action. Although off-site wells may reduce localized well impacts in the immediate vicinity of the SSEP, similar impacts would be experienced at the off-site well locations. This alternative was therefore dismissed from further consideration.

2.11.7.1.2 Type 1 Rights

Under this alternative, the SSEP would use nearby Type 1 Rights in place of a GIU permit to supply water to the Project Area. Because the number of grandfathered rights within the Phoenix AMA is fixed, and Type 1 Rights are tied to certain lands, the use of Type 1 Rights for the SSEP would potentially reduce or transfer existing groundwater withdrawals in the Rainbow Valley sub-basin. IGRs can only be used for irrigation of crops on designated irrigation acres, but in some cases these IGRs can be converted to a Type 1 Right and water may be transported for use somewhere off of the original irrigation acres. When an IGR is converted from an irrigation use to a Type 1 nonirrigation use, the amount of authorized withdrawals is generally reduced, creating a potential net decrease in total groundwater pumped over time. Because an IGR and the Type 1 Right resulting from the conversion of that IGR cannot be severed from the appurtenant land, Boulevard would be required to purchase the farm property where the IGR or Type 1 Right is located and then physically pump the water from the farm property to the power plant facilities. The farm property must also be maintained for the duration of the project but irrigation could no longer occur on retired irrigation acres.

In order to obtain sufficient groundwater withdrawal authority to support groundwater withdrawals of 2,500 afy, Boulevard would need to purchase roughly 900 grandfathered irrigation acres from a farm or farms within a reasonable distance of the proposed facilities. The availability of these acres is dependent on the current owners' willingness to sell the land, and could conceivably require the purchase of additional acreage to consummate the transaction and make it worthwhile to the seller. The price of this acreage will also vary based on local and national market conditions and demand.

This alternative has been eliminated from further analysis primarily because this alternative would significantly increase the cost of the SSEP and ultimately, the price of energy. Potential environmental benefits gained by a net pumping reduction in the Rainbow Valley Sub-basin may be off-set by the construction of water pipelines and pumping facilities, and the increased use of energy to transport the water to the project site.

2.11.7.1.3 Type 2 Rights

The number of Type 2 Rights in the Phoenix AMA is also fixed, and their availability is extremely variable in terms of quantity, time to acquire, and cost. Type 2 Rights are not specified for use in any particular sub-basin of the Phoenix AMA, so use of Type 2 Rights by the SSEP may not cause any corresponding decrease in existing groundwater withdrawals elsewhere in the Rainbow Valley sub-basin. Under this alternative, Boulevard would require Type 2 Rights to support groundwater withdrawals of 2,500 afy. Several smaller Type 2 Rights have sold in the Phoenix AMA in recent years, priced at roughly $1,500-$1,600 per acre-foot. These prices can vary substantially and may be skewed by speculative investment. It is not possible to predict when Type 2 Rights of sufficient size might become available or how much they might cost. Because of the availability of sufficient Type 2 Rights at a reasonable cost within the SSEP project timeline is uncertain, their use is considered speculative and has been eliminated from further analysis.

2.11.7.2 OFF-SITE GROUNDWATER WITHIN THE WEST SALT RIVER SUB-BASIN

Boulevard evaluated potential groundwater supplies from the West Salt River Sub-basin obtained through the Buckeye Water Conservation and Drainage District (BWCDD), the Roosevelt Irrigation District (RID), the Arlington Canal Company, and the Town of Buckeye. Each of these alternatives would require the construction of lengthy water pipelines along secured easements to deliver water to the SSEP area. Because Boulevard does not have the ability to claim eminent domain or condemn properties, it is not clear if a complete and sensible pipeline route could be secured in the future.

2.11.7.2.1 Roosevelt Irrigation District

Groundwater is not legally available from the RID. The District's groundwater withdrawal rights apply only to users within its service area. This service area is located north of the Gila River and, if available, would require the construction of an approximately 18-mile long water pipeline and associated pumping facilities. Consequently, this alternative is infeasible and eliminated from further consideration.

2.11.7.2.2 Town of Buckeye

The Town of Buckeye has physical and legal access to reliable, suitable quality groundwater supplies within its service area in both the Rainbow Valley and West Salt River Sub-basins. Buckeye is authorized to provide groundwater to industries within its service area through its withdrawal permits as long it can demonstrate that this service is consistent with the Phoenix AMA Third Management Plan and ADWR approves of the action (see A.R.S. § 45-491 et seq.).

Although the use of West Salt River Sub-basin groundwater would alleviate any localized pumping effects in the Rainbow Valley Sub-basin, it would still create effects farther away in a sub-basin that has more stored groundwater. Any local benefit resulting from a change in pumping location would be greatly outweighed by the impacts associated with construction of a lengthy, 20-mile pipeline and the energy needed to pump water to the Project Area. These impacts would continue for the life of the SSEP. Because this alternative would not resolve environmental issues, it was dismissed from further analysis.

2.11.7.2.3 BWCDD and Arlington Canal Company

Part of the West Salt River Sub-basin to the north of the SSEP is currently waterlogged. This means that the water table is close enough to the ground surface to endanger farming. BWCDD and the Arlington Canal Company are both located within this waterlogged area. Water is physically available, although the water is poor in quality, with TDS approaching approximately 3,000 milligrams per liter (mg/L). A significantly more robust water treatment system would be required to use water of this quality, which would increase the overall cost of the SSEP.

BWCDD is currently permitted to withdraw 30,000 acre-feet of groundwater per year until December 31, 2019. This pumping is authorized by a Drainage Permit issued by ADWR. Currently, this water is either delivered to the Arlington Canal Company or drained to the Gila River. A.R.S. § 45-519(B) authorizes BWCDD to use or convey this groundwater for a nonirrigation use if the recipient user also holds a Type 1 Right, a Type 2 Right, a GIU permit, or a service area groundwater withdrawal right. In order to obtain its Drainage Permit, BWCDD demonstrated that the drainage of irrigated lands was necessary to provide a reasonable economic return on the BWCDD lands' agricultural production and that the withdrawal of drainage water was consistent with the Phoenix AMA's Management Plan and goals. (A.R.S. § 45-519). ADWR is authorized to terminate the drainage permit if these conditions are no longer satisfied.

A water supply from BWCDD may not be reliable for the life of the SSEP because of the uncertainty regarding the continuation of agricultural uses in this area. BWCDD's Drainage Permit also expires on December 31, 2019, and it is unknown whether the waterlogged condition will continue as other groundwater uses develop in the sub-basin. Finally, because this permit is conditional, if prevailing conditions in the area change, the permit could be revoked prior to 2019.

Utilization of this water supply would require a pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and rights-of-way to construct this pipeline. An additional consideration is the uncertainty of a continued assured supply for the life of the SSEP (30 years).

The Arlington Canal Company is also within the waterlogged area, but does not currently have a Drainage Permit. Otherwise, the legal analysis of this alternative is identical to the BWCDD. The Arlington Canal Company is located even farther away from the proposed project, and would require a 26-mile pipeline. For the reasons described above, these alternatives have been abandoned from further analysis.

2.11.7.3 RECLAIMED WATER

Boulevard evaluated the effluent from six wastewater treatment plants (WWTPs) as potential supplies for the SSEP. Currently, none of the plants have an available and sufficient discharge volume to supply all the project needs (as proposed). Effluent from each source can be legally obtained through a purchase contract with the each WWTP and the effluent would then need to be piped to the project site across authorized easements or ROW entitlements. Each of these alternatives has been eliminated from further consideration for the reasons described below.

The City of Phoenix reported that effluent generated by the 91st Avenue WWTP is not currently available for sale. Similarly, the City of Goodyear reported that their WWTP had no excess effluent for sale. In both cases, all effluent is allocated by the cities for other uses and it does not appear likely that sufficient supplies would be available in the foreseeable future.

The Town of Gila Bend has a small WWTP that was recently permitted for peak discharges of 0.7 million gallons per day (MGD), but currently operates at a fraction of this volume. Even if this plant expanded output to its permitted maximum and discharged continuously at peak conditions, which is unlikely, this source would only supply roughly 784 afy, or 30% of the SSEP's water needs as proposed. This option would require the construction of a 31-mile pipeline to deliver water to the project site.

The Lewis State Prison, located northwest of the project site, may have approximately 365 afy available for purchase. This amount is less than one-sixth of the amount needed for the project and is not expected to increase in volume over time. This water would require an 11-mile pipeline for delivery to the project site, and Boulevard would need to develop a second water source to meet the water needs of the project.

Additionally, effluent discharged from the prison has created a wetland area, which is supported only by continuing prison discharges. The wetland would likely disappear if discharges stopped. The benefits from using prison effluent would be outweighed by the additional environmental effects of a lengthy pipeline, the destruction of a wetland, and the substantial costs of securing an additional water supply.

The Town of Buckeye's Central Buckeye WWTP is located approximately 20 miles north of the proposed Project Area and across the Gila River. The Central Buckeye plant currently generates approximately 1,300 afy of effluent with a typical TDS concentration of less than 1,000 mg/L and discharges the effluent to the Gila River. Buckeye expects this amount to increase at a rate of approximately 100 afy. Utilization of this water supply would require a 20-mile pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and rights-of-way to construct this pipeline, especially because it would involve a crossing of the Gila River. Finally, because the effluent is currently discharged to the Gila River, the river flows would be reduced and the downstream impacts of this are uncertain.

The brine streams from existing City of Goodyear and Town of Buckeye potable water treatment plants (WTP) were also identified as possible water sources. Because the Town of Buckeye no longer operates its potable water desalination treatment process, no brine is currently available. Goodyear may have a small amount of brine physically available at a location roughly 24 miles from the project. This brine has a TDS concentration of approximately 8,000 mg/L. The extremely high water treatment costs, combined with the added costs of a significant pipeline and ROWs acquisition make this option cost-prohibitive.

2.11.7.4 INDUSTRIAL WASTE WATER

No industrial wastewater sources are present or available.

2.11.7.5 SURFACE WATER

The physical and legal availability and the reliability of surface water in the vicinity of the SSEP are extremely speculative and have therefore been eliminated from further analysis. The most significant surface water source anywhere near the Project Area is the Gila River. The Gila River, which flows past the City of Phoenix 91st Avenue WWTP, is largely dependent on the effluent from this plant. The City of Phoenix and other WWTP contributors and downstream users are not legally obligated to continue to discharge effluent to the Gila River and it is likely that discharges to the Gila River will decrease in the future as effluent is reused for other purposes. Without effluent discharges, Gila River flows will be intermittent and unreliable.

Rights to use surface water are appurtenant to the land where historic and beneficial use occurs. Older surface water right claims in this area generally belong to farms within irrigation districts. The legal certainties of most surface water claims in this area are also questionable due to an ongoing adjudication case that will define all rights to use the Gila River and its tributaries. In order to obtain a surface water right or claim with a sufficient priority to capture available Gila River water flows, Boulevard would need to purchase land with an associated surface water claim of sufficient age to ensure legal viability. The water right must then be severed from the land and transferred to the SSEP for use. Because this severance and transfer process (outlined in A.R.S. § 45-172(A)(4)) requires the irrigation districts to consent to such a transfer, it is unlikely a severance and transfer would be successful. Even if a severance and transfer were allowed, the time required by ADWR to process a severance and transfer may exceed the SSEP timeline. Because of the significant procedural challenges, and long-term uncertainty of a continued supply, the use of surface water is not feasible.

2.11.7.6 CENTRAL ARIZONA PROJECT WATER

There is currently no physical or legal access to CAP water. The main CAP aqueduct is far from the Project Area. Despite this, CAP water may be "wheeled" through irrigation district canals with sufficient physical capacity. This wheeling requires the payment of a wheeling charge and a mutual agreement with the irrigation district. The closest available canal systems capable of delivering CAP water end roughly 18 miles and 30 miles from the Project Area. The water would then require a pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and ROWs to construct this pipeline.

Even if transportation of CAP water to the Project Area through a pipeline became feasible, the supply of CAP water for duration of the SSEP is uncertain. Boulevard is currently unable to secure a municipal or industrial CAP water allocation for SSEP. Existing users use all excess CAP water during 2008 and 2009 and the amount of excess CAP water is expected to decrease steadily in future years. Although several Indian communities have the legal right to provide long-term leases of CAP water to private users, recent lease inquiries have not been successful. Use of CAP water is not a feasible alternative because of its questionable physical availability, and the difficulty in gaining a legal right to use CAP water over the long term.

2.11.8 Crystallizer

A crystallizer is a piece of equipment designed to heat waste water in order to concentrate its impurities. The water would be reused and the byproduct would be a cake of impurities. The use of a crystallizer would reduce the SSEP's water use by approximately 7%.The use of a crystallizer was considered as a means of eliminating the need for evaporative ponds and reducing the amount of groundwater required for the SSEP.

The use of a crystallizer would create environmental benefits similar to the use of a brine concentrator. Because this option would cost nearly four times as much and the effects are similar to a brine concentrator (which is being carried forward for analysis), this alternative has been eliminated.

2.11.9 Alternate Configurations

It was suggesting during scoping that the SSEP be configured into six to eight widely spaced north-south rows to allow wildlife migration between the rows. This configuration was not carried forward for detailed analysis for a number of reasons. It is not feasible to place fences around each row of solar troughs with sufficient space in between to allow wildlife movement, without also reducing the size of the solar field and the plant's output. Additionally, the field is spaced to allow plant personnel to access the troughs with vehicles for maintenance, mirror washing, and emergency response. Creating multiple layers of secure fencing would prohibit and slow access, especially in an emergency situation. These movement corridors would also greatly increase the distance over which the HTF would need to be pumped. In a solar field of this size, that distance and the increased parasitic load would be considerable and adversely affect the plant's output. The increase in capital costs, additional risks to health and human safety, and the increased risk of animal injury warrant that this alternative not be carried forward for additional analysis.

<u>It was suggested during the draft EIS comment period that the SSEP be located further from the Sonoran Desert National Monument to minimize potential impacts to this sensitive resource. Given the constraints of available land parcels for sale or lease surrounding the Project Area, as well as increased visual and environmental impacts from moving the project further from existing infrastructure, it was not possible to locate the Project Area further from the monument under the Proposed Action or other action alternatives.</u>

2.11.10 Underground Transmission Lines

Public comments during scoping suggested the use of underground transmission lines. High-voltage transmission lines similar to what are proposed for the SSEP generate a substantial amount of heat when energized. In a confined space like an underground duct, this heat would create immense engineering, maintenance, and safety challenges. In addition to being technically infeasible, this alternative would be considerably more expensive and likely render the SSEP economically infeasible. For these reasons, this alternative was not carried forward for additional analysis.

2.11.11 Reduced Project Footprint with Dry Cooling

Public comments on the draft EIS suggest that an alternative that both reduces the project footprint and uses dry cooling be analyzed. This alternative was considered but not carried forward for detailed analysis because it would be substantially similar in design to Alternative B, except for its cooling system, which would be substantially similar in design to Alternative A. Because of this design similarity, it would also have substantially similar effects to Alternative B, except for water use and disposal, which would be substantially similar to Alternative A, but reduced by approximately one third. For these reasons, this alternative was not analyzed in detail as a stand-alone alternative. However, the impacts of this alternative would fall within the range of impacts analyzed, and the BLM could consider selecting both a reduced footprint and dry-cooled alternative in the ROD.

2.12 Comparison of Alternatives

Table 2.15 Comparison of Alternatives

	No Action	Proposed Action	Proposed Action with Brine Concentrator Option	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint	Alternative B: Reduced Footprint with Brine Concentrator Option
Total Project Footprint (solar field, linear, and well field uses)*							
Total disturbance area, including temporary and permanent use areas (acres)	–	3,620	3,620	3,609	2,013	2,394	2,394
Permanent use areas (acres)	–	3,589	3,589	3,580	1,984	2,363	2,363
Solar Field Components and Facilities*							
Solar field, internal roads, access areas, and internal linear facilities (acres)	–	3,313	3,385	3,385	1,907	2,136	2,184
Power blocks (acres)	–	80	80	80	0	80	80
Evaporation ponds (acres)	–	90	18	18	1	60	12
Land-treatment units (acres)	–	15	15	15	0	10	10
Stormwater detention basins (acres)	–	30	30	30	22	20	20
Linear Facilities (outside solar field)and Well field Facilities (permanent surface use areas)*							
New roads (miles/acres)	–	5.60/23.1	5.60/23.1	4.82/21.0	4.82/21.0	5.14/21.9	5.14/21.9
Upgraded roads (miles/acres)	–	4.62/20.4	4.62/20.4	4.23/18.7	4.89/20.8	4.62/20.1	4.62/20.1
Nonlinear groundwater well facilities (acres)	–	3.7	3.7	1.8	1.8	2.8	2.8
Generation tie line (miles/acres)	–	3.0/0.6	3.0/0.6	3.0/0.6	3.2/0.6	3.0/0.6	3.0/0.6
Gen-tie Line Option (miles/acres)	-	3.4/1.1	3.4/1.1	3.4/1.1	3.6/1.2	3.4/1.1	3.4/1.1
Electrical supply lines (miles/acres)	–	2.61/7.3	2.61/7.3	1.44/4.0	1.74/4.7	2.15/6.0	2.15/6.0
Pipelines (subsurface use only)*							
Water pipelines-outside solar field (miles/acres)	–	5.19/5.0	5.19/5.0	4.02/3.9	4.7/4.52	4.73/4.6	4.73/4.6
Water pipelines-inside solar field (miles/acres)	–	2.10/2.0	2.10/2.0	2.10/2.0	2.04/1.97	2.19/2.1	2.19/2.1
Gas pipelines-outside solar field (miles/acres)	–	1.06/1.0	1.06/1.0	1.06/1.0	n/a	1.06/1.0	1.06/1.0
Gas pipelines-inside solar field (miles/acres)	–	2.10/2.0	2.10/2.0	2.10/2.0	–	2.19/2.1	2.19/2.1

Table 2.15 Comparison of Alternatives

	No Action	Proposed Action	Proposed Action with Brine Concentrator Option	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint	Alternative B: Reduced Footprint with Brine Concentrator Option
Electrical Generation							
Instantaneous generation capacity (MW)	–	375	375	375	300	250	250
Annual output, assuming solar generation only (MWh)	–	870,000	870,000	764,400	775,000	540,000	540,000
Annual output, assuming 25% generation from thermal storage and/or gas co-firing (MWh)	–	1,155,000	1,155,000	1,051,050	n/a	770,000	770,000
Generation storage capacity (hours)	–	3–4	3–4	3–4	0	3–4	3–4
Water Requirements							
Average annual water use (afy)	–	3,003–2,305	2,793–2,144	151–116	65	2,003–1,518	1,863–1,412
Peak daily water usage (acre-feet)	–	12.8–11.9	11.9–11.0	0.4	0.1	10.2–7.8	9.5–7.3
Annual water use in Gallons per MWh	0	1,125–863	1,046–803	57–43	24	750–569	698–529
Natural Gas Use and Co-firing							
Annual maximum co-firing generation (MW Hours)	–	274,000	274,000	250,000	n/a	180,000	180,000
Annual maximum natural gas usage (MMBtu)	–	3,982,000	3,982,000	3,623,620	n/a	2,655,000	2,655,000
Construction Workforce							
Construction workers at peak of construction	–	1,500	1,500	1,500	378	1,350	1,350
Max vehicle trips per hour at peak of construction	–	1,000	1,000	1,000	355	950	950
Estimated Capital Costs**							
Capital Cost ($ in billions)	–	1.69–2.36	–	1.76–2.46	1.14–1.32	1.13–1.58	–
Capital Cost per MWh ($)***		598–794	–	762–1,048	1,471–1,703	598–853	–

* Because of overlap between permanent and temporary features, and between linear, solar field, and well field facilities, the acreages presented in the table are not additive. Please refer to the "Total Project Footprint" rows for the sum or all project disturbance/use areas.

** Estimated capital costs are based on 2008 data from the Beacon Solar Energy Project Dry Cooling Evaluation, the 2008 LAZARD "Levelized Cost of Energy Analysis" presentation at NARUC, and the 2011 Historical Summary of the Installed Cost of Photovoltaics in the United States It should be noted that PV costs have likely decreased over the last three years. In addition, overall costs can vary significantly according to panel selection. These costs do not reflect forward pricing on panel costs for the 2013–2015 time frame.

*** For the Proposed Action, Alternative A, and Alternative B, the high end of the Capital Cost per MWh ranges was calculated using the annual output assuming solar generation only for each alternative. The low end of the ranges was calculated using the annual output assuming 25% generation from thermal storage and/or gas co-firing. For Sub-alternative A1, a solar generation-only output of 775,000 MWh was used to calculate both figures.

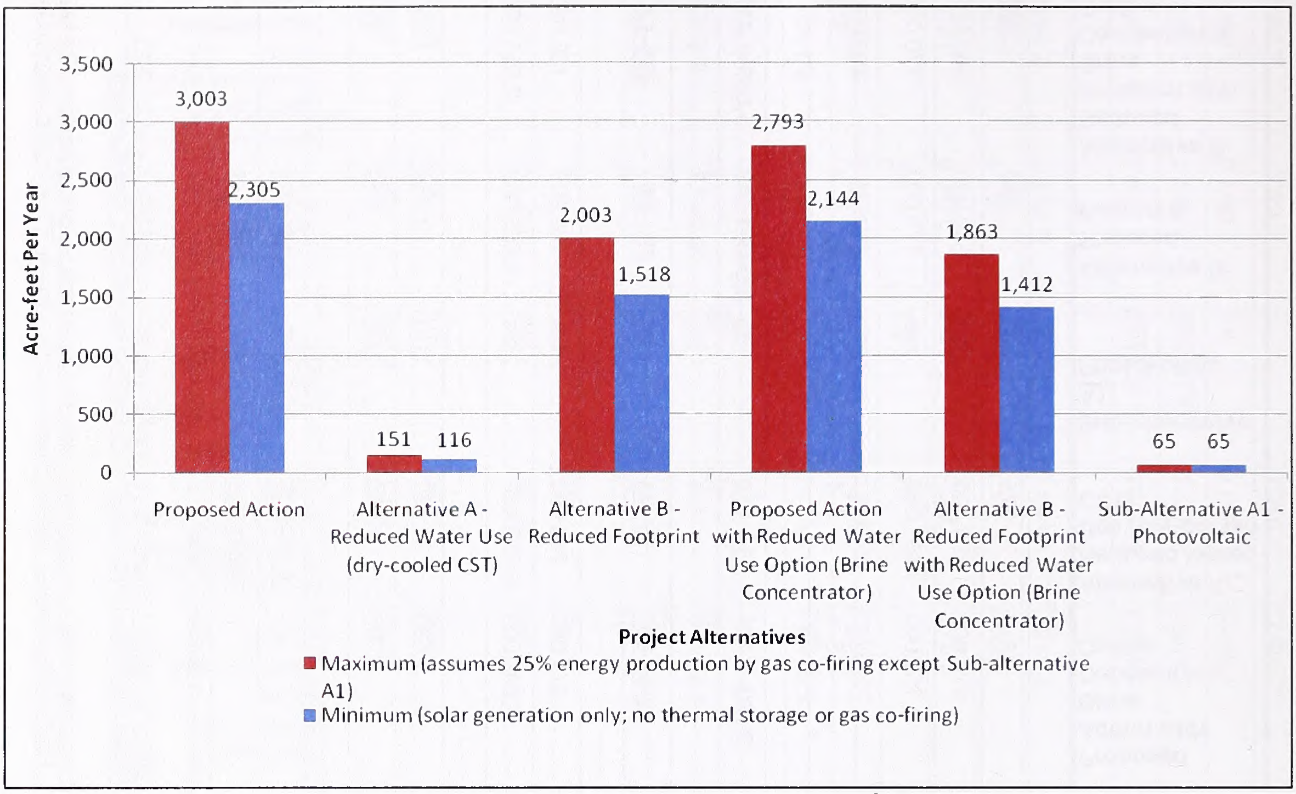

Figure 2.15 Average annual water use under each action alternative and option.

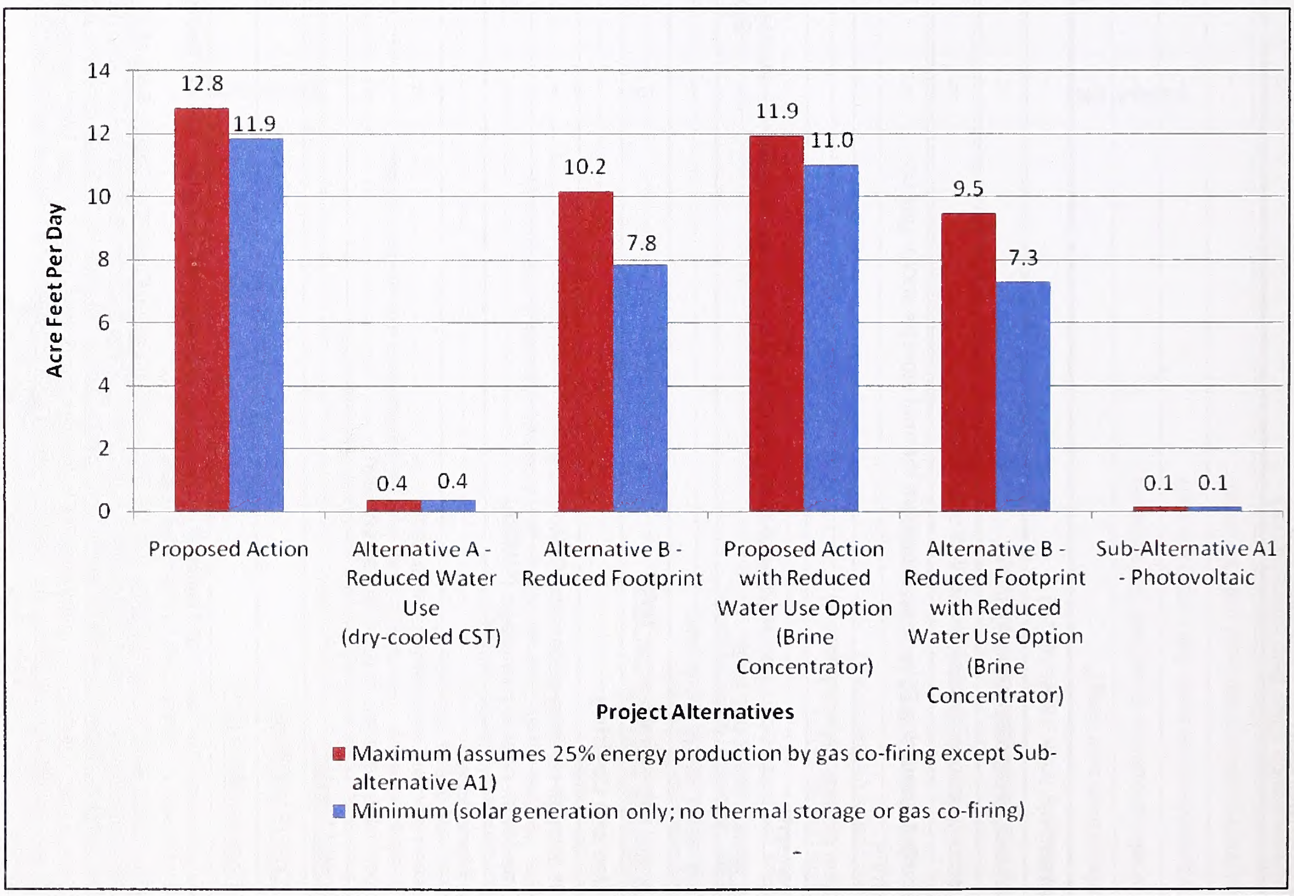

Figure 2.16 Peak daily water use under each action alternative and option.

2.13 Summary of Impacts

Please see the following table (Table 2.16).

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Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
AIR QUALITY					
Project emissions during construction	There would be no project construction emissions under the No Action alternative.	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles, and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under the Proposed Action would be • PM_{10}: 8.8 (0.12% over current emissions) • PM2.5: 2.3 (0.15% over current emissions) • NOx: 14.7 (0.14% over current emissions) • CO: 6.1 (0.01% over current emissions) • VOC: 1.6 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Alternative A would be • PM_{10}: 8.8 (0.12% over current emissions) • $PM_{2.5}$: 2.3 (0.15% over current emissions) • NO_x: 14.7 (0.14% over current emissions) • CO: 6.1 (0.01% over current emissions) • VOC: 1.6 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Alternative B would be • PM_{10}: 8.6 (0.12% over current emissions) • $PM_{2.5}$: 2.1 (0.14% over current emissions) • NO_x: 9.7 (0.09% over current emissions) • CO: 3.7 (<0.01% over current emissions) • VOC: 1.1 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Sub-alternative A1 would be • PM_{10}: 6.1 (0.09% over current emissions) • $PM_{2.5}$: 1.4 (0.10% over current emissions) • NO_x: 7.2 (0.07% over current emissions) • CO: 1.57 (<0.001% over current emissions) • VOC: 0.40 (0.002% over current emissions)
Project emissions during operations	There would be no project operational emissions under the No Action alternative.	Emissions of criteria pollutants during operation of the SSEP would result from the cooling towers, windblown dust, and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under the Proposed Action would be • PM_{10}: 40.9 tpy (0.05% over current emissions) • $PM_{2.5}$: 22.2 tpy (0.13% over current emissions) • NO_x: 28.9 tpy (0.02% over current emissions) • CO: 95.8 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 14.2 tpy (0.01% over current emissions) • HAPs: 3.5 tpy	Emissions of criteria pollutants during operation of the SSEP would result from windblown dust and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under Alternative A would be • PM_{10}: 20.2 tpy (0.02% over current emissions) • $PM_{2.5}$: 9.5 tpy (0.05% over current emissions) • NO_x: 26.4 tpy (0.02% over current emissions) • CO: 87.2 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 12.9 tpy (<0.01% over current emissions) • HAPs: 3.2 tpy	Emissions of criteria pollutants during operation of the SSEP would result from the cooling towers, windblown dust, and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under Alternative B would be • PM_{10}: 27.6 tpy (0.03% over current emissions) • $PM_{2.5}$: 15.1 tpy (0.09% over current emissions) • NO_x: 22.8 tpy (0.02% over current emissions) • CO: 68.5 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 9.6 tpy (<0.01% over current emissions) • HAPs: 2.5 tpy	Emissions of criteria pollutants during operation of the SSEP would result from fugitive dust. Maximum annual emissions under Sub-alternative A1 would be • PM_{10}: 15.8 tpy (0.02% over current emissions) • $PM_{2.5}$: 1.6 tpy (0.009% over current emissions) • NO_x: 0 tpy (0% over current emissions) • CO: 0 tpy (0% over current emissions) • SO_2: 0 tpy (0% over current emissions) • VOC: 0 tpy (0% over current emissions) • HAPs: 0 tpy
Incremental contributions to existing NAAOS	There would be no additional contribution to NAAOS under No Action. Background data at the Buckeye monitoring station indicate routine exceedances of the 24-hour PM_{10} NAAOS (150 $\mu g/m^3$), the annual PM_{10} NAAOS (50 $\mu g/m^3$), and the 24-hour $PM_{2.5}$ NAAOS (35 $\mu g/m^3$). All of the current emissions in Maricopa County would continue to contribute to these.	Operation of the SSEP under the Proposed Action would contribute, at most, 0.562 $\mu g/m^3$ of PM_{10} and 0.557 $\mu g/m^3$ of $PM_{2.5}$ to the 24-hour PM_{10} NAAOS (150 $\mu g/m^3$), and 0.113 $\mu g/m3$ to the annual PM_{10} NAAOS (50 $\mu g/m^3$). Construction emissions would also contribute to all PM NAAOS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	Operation of the SSEP under Alternative A would contribute, at most, 0.28 $\mu g/m^3$ of PM_{10} and 0.24 $\mu g/m^3$ of $PM_{2.5}$ to the 24-hour PM_{10} NAAOS (150 $\mu g/m3$), and 0.06 $\mu g/m^3$ to the annual PM_{10} NAAOS (50 $\mu g/m^3$). Construction emissions would also contribute to all PM NAAOS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	Operation of the SSEP under the Alternative B would contribute, at most, 0.38 $\mu g/m^3$ of PM_{10} and 0.38 $\mu g/m^3$ of $PM_{2.5}$ to the 24-hour PM_{10} NAAOS (150 $\mu g/m3$), and 0.08 $\mu g/m^3$ to the annual PM_{10} NAAOS (50 $\mu g/m^3$). Construction emissions would also contribute to all PM NAAOS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	There would not be any point sources of emissions under Sub-alternative A1; therefore, the SSEP would not result in any substantive contributions to NAAOS.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Visibility of emissions plumes	Under No Action, there would be no visible plumes from the Project Area.	The Proposed Action would result in a visible emissions plume less than 1% of the time at three recreational areas in the vicinity: Sonoran Desert National Monument, North Maricopa Mountains Wilderness, and Buckeye Hills Regional Park. A vapor plume would also be visible during early morning hours, less than ten days per month, from December through February, and less than five days per month in November and March.	Plume visibility associated with Alternative A would be the same or less than the impact described for the Proposed Action. Under Alternative A, there would not be any vapor plumes associated with the cooling towers.	Plume visibility associated with Alternative B would be the same or less than the impact described for the Proposed Action. There would be a slightly smaller likelihood of vapor plumes under Alternative B as compared to the Proposed Action.	There would not be any plumes under Sub--alternative A1.
CLIMATE CHANGE[1]					
Lifetime GHG emissions from vegetation removal, construction, and 30-year operation (Mt CO2e)	0	6,885,050	6,312,914	4,751,754	25,203
Lifetime GHG emissions avoided from grid electricity (Mt CO2e)	0	-20,714,872	-18,850,534	-13,809,915	-13,899,589
Net lifetime GHG emissions before potential mitigation measures (Mt CO2e)	0	-13,829,822	-12,537,820	-9,058,160	-13,874,386
Net lifetime GHG emissions after potential mitigation measures (Mt CO2e)	0	-13,841,033	-12,548,809	-9,063,469	-13,879,425
[1] Climate Change Note: GHG savings and emissions levels less than zero indicate an overall reduction in GHGs. Net lifetime GHG emissions levels less than zero also indicate an overall net mitigation of climate change.					
CULTURAL RESOURCES					
Recorded Site AZ T:10:238 (ASM)	No impacts	AZ T:10:238 (ASM) is eligible for the NRHP. Under all action alternatives, the site would be 100% disturbed by construction of the power plant, and the project would result in short- and long-term direct adverse effects to the site. Through a program of data recovery, this adverse effect (as determined under Section 106) could be mitigated. Additionally, the new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP eligibility.			
Recorded Site AZ T:14:165 (ASM)	No impacts	AZ T:14:165 (ASM) is eligible for the NRHP. Under all action alternatives, no ground disturbance of the site would occur. The new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP eligibility.			
Recorded Site AZ T:14:167 (ASM)	No impacts	AZ T:14:167 (ASM) is eligible for the NRHP. Under all action alternatives, no ground disturbance of the site would occur. The new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP eligibility.			
GEOLOGY AND MINERALS					
Geologic Formations Affected		3,620 acres of disturbance would occur within two geologic units: 3,616 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	3,609 acres of disturbance would occur within two geologic units: 3,605 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	2,394 acres of disturbance would occur within two geologic units: 2,390 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	2,013 acres of disturbance would occur within two geologic units: 2,010 acres within undivided Quaternary alluvium and 3 acres within younger Quaternary alluvium.
Potential Preclusion of Minerals Use		3,620 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	3,809 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	2,394 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	2,013 acres of potentially salable sand and gravel would be precluded from use for the life of the project.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE					
Hazardous materials, hazardous waste, and solid waste used/stored on-site	No impacts from construction or operation of the SSEP. Current activities in the area would not result in the generation, use, or disposal of hazardous materials and hazardous and solid waste within the Project Area.	Under all these action alternatives, SSEP construction and operation activities would generate certain hazardous and nonhazardous solid waste streams, increasing the risk of leaks and spills with the potential to affect human health or contaminate surrounding soils, surface waters, and groundwater. Hazardous materials and wastes and regulated, nonhazardous solid wastes are governed by all applicable LORS and a full spill prevention plan (SPP) would be developed and implemented prior to construction of the SSEP. With adherence to these LORS as well as the applicant-committed environmental protection measures and implementation of the SPP, there would be no impacts to human health and safety or surrounding soils, surface water, and groundwater. In addition, a variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials (e.g., a hazardous material business plan). The following is a list of materials generated or used under the Proposed Action: • Hydrogen: 63,000 standard cubic feet (335 pounds) at one time • Compressed gas: 800 cubic feet each of acetylene, argon, and oxygen at one time • Petroleum products Lube oil: 10,000 gallons (used); 550 gallons (on-site) Mineral insulating oil: 32,000 gallons Diesel fuel: 300 gallons • Activated and spent carbon 4,000 pounds activated (on-site) 400,000 pounds spent/year (generated) • Herbicides: approximately 37,000 pounds/year (24,050 pounds/year for Alternative B) • Waste mirror glass: unquantified • Hydraulic fluids, oils, greases Fluids and oils: 70,000 gallons/year Oily effluent: 5,000 gallons/year Oily rags and filters: six 55-gallon drums/month • Solvents and cleaning solutions: 500 gallons/year • Soil stabilizer: used immediately • Universal wastes: 75 items/month • Construction wastes Containers of hazardous waste: 2 cubic yards/week Solvents, oil paint, rags: 200 gallons/90 days Heat exchanger/boiler fluids: 1,000 gallons Batteries: 20 Herbicides: 50 gallons Wood, concrete, steel, plastic: 40 cubic yards/week Paper, aluminum, plastic, food: 200 gallons/ day Generation of electric and magnetic fields (EMF) would occur under all action alternatives.			Under Sub-alternative A1, no activated and spent carbon or hydrogen volumes would be required. No waste mirror glass would be generated. Approximately 20,350 pounds of herbicides would be used annually. PV panels, which may contain hazardous materials sealed within the panels, will be used onsite. The generation of other hazardous and nonhazardous solid waste streams would be the same as the Proposed Action.
Heat transfer fluid (HTF)	No HTF would be within the Project Area under the No Action alternative.	1,500,000 gallons of HTF would be in use under the Proposed Action.	No change from the Proposed Action.	1,050,000–1,125,000 gallons of HTF would be in use, which is a reduction of 375,000–450,000 gallons when compared to the Proposed Action.	No HTF would be required under Sub-alternative A1.
Natural gas	No natural gas would be used within the Project Area under the No Action alternative.	3,982,000 MMBtu/year would be used within the Project Area.	3,623,620 MMBtu/year would be used within the Project Area, a reduction of 358,380 MMBtu/year when compared to the Proposed Action.	2,655,000 MMBtu/year would be used within the Project Area, a reduction of 1,327,000 MMBtu/year when compared to the Proposed Action.	No natural gas pipeline would be required under Sub-alternative A1.
Water treatment Chemicals	No natural gas would be within the Project Area under the No Action alternative.	Under all action alternatives the following water treatment chemicals would be used and stored on site: • 8,500 gallons sodium hydroxide, 50% solution • 17,000 gallons sodium hypochlorite, 12.5% solution • 16,000 gallons sulfuric acid, 93% solution			No sodium hydroxide, hypochlorite, or sulfuric acid would be required under Sub-alternative A1. Daily water treatment chemicals would consist of one 55-gallon tote of bisulfate and one 15-gallon tote of anti-scalant.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
LAND USE AND ACCESS					
Current land uses precluded by SSEP development	Current land uses such as grazing, mining, utility corridors, dispersed recreation, low-density residential, and transportation would continue with no change to use type.	Preclusion of grazing and recreational land uses on approximately 3,6200 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with 69 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (1.6% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.	Same as Proposed Action.	Preclusion of grazing and recreational land uses on approximately 2,363 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with 15 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (7.3% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.	Preclusion of grazing and recreational land uses on approximately 1,983 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with approximately 12 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (7.3% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.
Consistency with other land-use plans	Not applicable.	Under all action alternatives, land use would be consistent with the *Lower Gila South Resource Management Plan* (BLM 1985), *Maricopa County Comprehensive Plan* (Maricopa County 2002), *Goodyear General Plan* (City of Goodyear 2003), *and Town of Buckeye General Plan* (Town of Buckeye 2008a).			
LIVESTOCK GRAZING					
Grazing	No change to number of acres in the Beloat or Arnold grazing allotments. No loss of forage or AUMs in either allotment.	Conversion of 2,649 acres of the Beloat grazing allotment and 971 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 78 AUMs and 44 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. Removal of the CCC stock pond would reduce available water sources for livestock and would impact foraging ability.	Same as the Proposed Action.	Conversion of 1,397 acres of the Beloat grazing allotment and 966 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 38 AUMs and 41 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. CCC stock pond would remain available for livestock use.	Conversion of 1,051 acres of the Beloat grazing allotment and 932 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 31 AUMs and 39 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. CCC stock pond would remain available for livestock use.
NOISE					
Construction Noise	No project-related noise impacts would occur.	Construction-related noise would range from 34 to 54 dBA during the busiest periods of activity at each of the receptor locations.	Impacts would be the same as those described under the Proposed Action.	Increased ambient noise levels from construction-related noise would be similar to that described under the Proposed Action, but would occur over a shorter duration. The reduced footprint under Alternative B would result in reduced audible construction noise at nearby residences (Receptors ST-2, LT-1, and LT-2) when compared to the Proposed Action.	Increased ambient noise levels from construction activities would be discernible during the busiest periods of construction activity. This would be comparable but typically lower than predictions for the Proposed Action. Construction traffic noise for Sub-alternative A1 would be the same as the Proposed Action.
Exterior Noise in Goodyear	No project-related noise impacts would occur. Other activities would produce minimal noise.	Exterior noise levels in the range of 51–54 dBA would be experienced at the noise receptor in the Goodyear Planning Area (ST-2) for intermittent short-term periods when construction activities are occurring in that area.	Impacts would be the same as those described under the Proposed Action.	Construction activities would occur further from residential areas to the east, represented by ST-2. The increased distance would result in reduced audible construction noise at nearby residences when compared to the Proposed Action.	Exterior noise levels in the range of 38–46 dBA would be experienced at the noise receptor in the Goodyear Planning Area (ST-2) for intermittent short-term periods when construction activities are occurring.
Temporary Venting Noise	No project-related noise impacts would occur.	During commissioning and initial start-up, the frequency, length, and noise intensity of ventings can be as loud as 130 dBA at a distance of 100 feet. Temporary vent silencers would be used during this period to reduce the noise levels by 20–30 dB.	Impacts would be the same as those described under the Proposed Action.	Impacts would be essentially the same as those described under the Proposed Action.	No venting would occur during start-up of Sub-alternative A1.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Operational Noise	No project-related noise impacts would occur.	In the Goodyear Planning Area (ST-2), SSEP daytime contributions would be 5–7 dBA above hourly average noise levels (L_{eq}).	Impacts would be the same as those described under the Proposed Action.	Because operation noise levels would be primarily controlled by the power block equipment and not by the solar field equipment, changes in the size of the solar field for this alternative would not change the SSEP noise environment relative to the Proposed Action.	The SSEP under Sub-alternative A1 would have no major rotating equipment, no fired heaters, no cooling facilities, and no pressurized systems. Operational noise levels would be below ambient noise levels under this alternative.
PALEONTOLOGY					
	No impacts.	Low probability that the 3,620-acre Project Area subject to surface disturbance contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are likely.	Low probability that the 3,609-acre Project Area subject to surface disturbance contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are likely.	Low probability that the 2,394-acre Project Area contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are likely.	Low probability that the 2,013-acre Project Area contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are likely.
RECREATION AND WILDERNESS CHARACTERISTICS					
Recreation	No change in acres of public lands managed as semiprimitive motorized in the Recreation Opportunity Spectrum (ROS). No lost opportunities for solitude and primitive recreation or effects to nearby recreation areas. No loss of acres of wilderness characteristics.	Removal (and conversion to an industrial use setting) of approximately 3,500 acres of extensive recreation management area classified as ROS semiprimitive motorized. Loss of 3,500 acres with opportunities to participate in recreational activities such as hiking, biking, backcountry driving, hunting, and horseback riding. Reduced recreational experience and setting in the Sonoran Desert National Monument, North Maricopa Mountains Wilderness, Sierra Estrella Wilderness, and the Buckeye Hills Regional Park by alteration of the viewshed from a more natural setting to an industrial setting and by introduction of noise that would affect the recreational experience for a typical visitor seeking solitude near the perimeter of these areas. However, as visitors venture deeper into the adjacent recreation areas and further from the Project Area, noise intrusions would lessen and eventually cease.	Same as the Proposed Action.	Same as the Proposed Action except there would be approximately 2,300 acres (1,200 acres less than the Proposed Action) converted from an extensive recreation management area (ERMA) and ROS category semiprimitive to an industrial site.	Same as the Proposed Action except there would be approximately 2,013 acres converted from an ERMA and ROS category semiprimitive to an industrial site (approximately 1,500 acres less than the Proposed Action).
Wilderness characteristics	No change to the area under consideration as having wilderness characteristics because opportunities for solitude and primitive recreation would not be diminished. There would be no impacts to the natural character because no component of the project would be constructed in the area being considered for wilderness character.	Under all action alternatives, there would be no impacts to the size or naturalness of the unit under consideration for having wilderness characteristics. Reduction of the recreational setting and experience (e.g., solitude, isolation) for sensitive viewers due to the visual impacts of project components would occur. Effects from visual disturbances on the desired setting would dissipate as visitors ventured farther into the core of the area.			
SOCIOECONOMICS					
Social	Current land uses (livestock grazing and recreation) would continue to contribute to the current quality of life in the local communities.	Under all action alternatives, the SSEP would result in a population increase of less than 0.3% in Goodyear, Buckeye, or Maricopa County. Potential short-term decrease in property values of up to 14.9% in houses located within 0.15 mile of SSEP. Residential properties located more than 0.6 mile from SSEP would have no discernable effect on property values. Changes to quality of life could be experienced by local residents and/or visitors to the area who have traditionally identified with the rural, undeveloped landscape. The change in setting to a more industrial feel could adversely impact these individuals throughout the life of the project.			

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Economic	Economic contributions generated from grazing operations and dispersed recreation would remain similar to current conditions.	**Construction**: Annual employment (direct, indirect, and induced) would total 1,606 full-time jobs. Annual labor income would total approximately $84,402,211. Annual output (gross sales or revenues) would total $221,622,804. **Operations**: Annual employment would total 208 full-time jobs. Annual labor income would total approximately $16,857,069. Annual output would total approximately $71,454,759. **Maximum annual electricity output**: 1,155,000 MWh; this is equivalent to the supply needs for approximately 87,899 residential units.	Same as Proposed Action. **Maximum annual electricity output**: 1,051,050 MWh; this is equivalent to the supply needs for approximately 79,988 residential units.	**Construction**: Annual employment would total 1,445 full-time jobs. Annual labor income would total approximately $75,961,990. Annual output would total approximately $199,459,652. **Operations**: Annual employment would total 183 full-time jobs. Annual labor income would total approximately $14,749,935. Annual output would total approximately $62,533,914. **Maximum annual electricity output**: 770,000 MWh; this is equivalent to the supply needs for approximately 58,599 residential units.	**Construction**: Annual employment would total 639 full time jobs. Annual labor income would total approximately $36,118,518. Annual output would total approximately $88,753,140. **Operations**: Annual employment would total 42 full time jobs. Annual labor income would total approximately $3,371,414. Annual output would total approximately $14,290,951. **Maximum annual electricity output**: 775,000 MWh; this is equivalent to the supply needs for approximately 58,980 residential units.
Fiscal	Grazing fees collected by the BLM for the two allotments would generate amounts similar to current contributions, totaling approximately $5,362.	**Construction**: State and county tax revenue from local purchases would total approximately $1.1 million and $133,000, respectively. Additional city sales tax revenues would total up to $570,000. Transaction privilege tax and payroll tax would contribute approximately $8.8 million throughout construction. City-levied privilege taxes would generate up to $5.6 million. A 7.1% decrease in AUMs, compared to No Action, would result in an approximately $381 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $17,920 and $2,227, respectively. Transaction privilege tax and payroll tax base would contribute approximately $158,000 in state and county revenue. City-levied privileged taxes would generate up to $80,000 annually. Annual property taxes would total up to $25 million and decrease as equipment depreciates. BLM annual rental fees would total $696,858. The BLM MW capacity fee would be approximately $164,250 in 2013 and increase to $2,463,780 annually.	Same as Proposed Action.	**Construction**: State and county tax revenue would total approximately $1.04 million and $126,350, respectively. Transaction privilege tax and payroll tax would contribute $7.9 million. City-levied privilege taxes would generate up to $5 million. A 5.5% decrease in AUMs would result in an approximately $294 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $10,752 and $1,344, respectively. Transaction privilege tax and payroll tax base would contribute approximately $138,250 to state and county revenue. City-levied privilege taxes would generate up to $70,000 annually. Annual property taxes would total up to $17.5 million and decrease as equipment depreciates. BLM annual rental fees would total $436,948. The BLM MW capacity fee would be approximately $821,250 in 2013 and increase to $1,642,500 annually.	**Construction**: State and county tax revenue would total approximately $798,000 and $98,000, respectively. Transaction privilege tax and payroll tax would contribute $3.1 million. City-levied privilege taxes would generate up to $3 million. A 5% decrease in AUMs would result in an approximately $93.00 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $15,400 and $1,925, respectively. Transaction privilege tax and payroll tax base would contribute approximately $61,425 to state and county revenue. City-levied privilege taxes would generate up to $39,000 annually. Annual property taxes would total up to $15.5 million and decrease as equipment depreciates. BLM annual rental fees would total $376,680. The BLM MW capacity fee would be approximately $105,120 in 2013 and increase to $1,576,800 annually.
Environmental justice	No impacts.	Under all action alternatives, no impacts were identified that would disproportionately affect potential EJ populations living within a 5-mile radius of the SSEP.			
SOILS					
Acres of long-term soil disturbance	No new impacts to soils would occur under No Action, although some soil impacts associated with current livestock grazing practices would continue in the Project Area. Impacts under this alternative would include soil compaction due to grazing, but it would generally be limited to discrete paths or livestock congregation areas. Recreation in the Project Area, including mostly hiking, horseback riding, and OHV travel, would not be expected to impact soils due to its limited use.	Long-term disturbance to soils would occur from the clearing of vegetation, grading of the project footprint to a 3% slope, compaction within the project footprint, and from the improvement and construction of roads in the Project Area. Long-term disturbance would occur on 3,589 acres. Long-term disturbance to soils and biological soil crusts (BSCs) would occur from the loss of soil biota due to the use of 37,000 pounds of herbicide annually to control vegetation in the solar field.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 3,580 acres of long-term disturbance, a reduction of 9 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs from herbicide use in the solar field would be the same as under the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 2,363 acres of long-term disturbance, a reduction of 1,226 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs would be of the same nature as under the Proposed Action, but would entail 24,050 pounds of herbicides applied annually, or 35% less herbicide than under the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 1,984 acres of long-term disturbance, a reduction of 1,605 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs would be of the same nature as under the Proposed Action, but would entail 20,350 pounds of herbicides applied annually, or 45% less herbicide than under the Proposed Action.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Acres of short-term soil disturbance	Same as above.	Short-term disturbance to soils would occur from the installation of the buried gas and water lines and from temporary access roads. Short-term disturbance would occur on approximately 31 acres.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 29 acres of short-term disturbance, a reduction of 2 acres when compared to the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 30 acres of short-term disturbance, a reduction of 1 acre when compared to the Proposed Action.	Same as Alternative A.
Disturbance to sensitive soils	Same as above.	• 0.6% of long-term disturbance and 33.8% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 8.2% of long-term disturbance and 46.8% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • 99% of both total long-term and short-term disturbance under the Proposed Action would occur in soils with moderate alkalinity. • No disturbance would occur in soils with limited rooting depth or high salinity. • 21.4% of long-term disturbance and 15.8% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.	The slight reduction in acres of disturbance would not affect the relative percentage of impact to soil types (as compared to the total acreage of soil disturbance).	• 0.7% of long-term disturbance and 32.1% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 2.0% of long-term disturbance and 0% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • There would be no change in the total long-term and short-term disturbance in soils with moderate alkalinity when compared to the Proposed Action. • No disturbance would occur in soils with limited rooting depth or high salinity. • 29.7% of long-term and 16.2% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.	• 0.8% of long-term disturbance and 31.1% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 2.6% of long-term disturbance and 1.7% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • 99% of both total long-term and short-term disturbance would occur in soils with moderate alkalinity. • No disturbance would occur in soils with limited rooting depth or high salinity. • 26.5% of long-term and 30.0% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.
SPECIAL DESIGNATIONS					
	No acreage within special designation areas would be disturbed. No effects on wildlife or their habitat, or to recreation opportunities in the Sonoran Desert National Monument and wilderness.	No acreage within special designation areas would be disturbed. Presence and view of the facility on 3,620 acres would degrade desired primitive recreation setting and experience (e.g., solitude and isolation) for some distance into the adjacent wilderness. The facility and associated linear facilities (roads, water and gas pipelines, and power lines) would create barriers to wildlife movement to and from the adjacent wilderness and the Sonoran Desert National Monument. Construction and operation of the facility would create increased noise levels.	Same as the Proposed Action.	Same as the Proposed Action, but to a lesser degree, as the facility would remove 37% less footprint than the Proposed Action.	Under Sub-alternative A1, the facility would present less of a landscape change and less of an adverse impact to visitors in special designation areas than under the Proposed Action, because 45% less vegetation would be removed from the project footprint. Vehicle trips would be reduced by 73%, reducing barriers to wildlife movement. Construction noise would be similar to that predicted for the Proposed Action. Operational noise levels would be below ambient noise levels under this alternative and would not affect the recreational experience. Sub-alternative A1 would be less reflective and have a lower profile than the Proposed Action, reducing visual impacts to special designations.
TRANSPORTATION AND TRAFFIC					
Level of Service (LOS)	LOS for the SR-85/Riggs Road intersection would continue at existing levels.	The LOS for the SR-85/Riggs Road intersection would be rated lower. Traffic at the SR-85/Riggs Road intersection would increase by approximately nine times during peak construction. LOS would go from LOS B or better to LOS B or worse ranging to LOS F.	Impacts would be similar to the Proposed Action except for a slight increase in the amount of worker vehicles traveling to and from the SSEP during the peak construction period. This slight increase would not affect the LOS during peak construction.	Impacts would be similar to the Proposed Action except for a shorter duration of peak construction traffic. This shorter duration would not affect the LOS during peak construction.	The LOS for the SR-85/Riggs Road intersection would be rated higher than the other action alternatives. Traffic at the SR-85/Riggs Road intersection would result in a lower LOS during the morning commute at peak construction only. LOS would go from LOS B to LOS C during peak construction.
Routes	Public use of the existing route network (13.1 miles of primitive roads) would continue at existing levels. No new routes would be constructed. No existing routes would be upgraded.	Construction of the SSEP would close 7.4 miles of primitive roads currently available for public use.	Same as the Proposed Action	Construction of the SSEP would close 3.7 miles of primitive roads currently available for public use.	Construction of the SSEP would close 3 miles of primitive roads currently available for public use.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
VEGETATION AND SPECIAL-STATUS SPECIES					
Vegetation communities	Reclamation of several test well sites would have long-term beneficial impacts on native vegetation through restoration of the structural diversity and functioning of vegetation communities.	Direct impacts to vegetation communities from the removal of 3,600 acres of Sonoran Creosotebush-Bursage Scrub (including 38,555 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 1,000 vehicle round-trips per day on paved roads during peak construction, and 46 vehicle round-trips per day during regular operations.	Direct impacts to vegetation communities from the removal of 3,590 acres of Sonoran Creosotebush-Bursage Scrub (including 38,478 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with travel would be the same as under the Proposed Action.	Direct impacts to vegetation communities would result from the removal of 2,374 acres of Sonoran Creosotebush-Bursage Scrub (including 22,122 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 950 vehicle round-trips per day on paved roads during peak construction and 46 vehicle round-trips per day during regular operations.	Direct impacts to vegetation communities would result from the removal of 1,992 acres of Sonoran Creosotebush-Bursage Scrub (including 22,461 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 267 vehicle round-trips per day on paved roads during peak construction and 16 vehicle round-trips per day during regular operations.
Special-status plant species	No project-related impacts to special-status plant species.	Direct adverse impacts to 12 Arizona Department of Agriculture (ADA)-protected special-status plant species from salvage or loss of all plants on 3,600 acres (including 38,555 linear feet of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 3,590 acres (including 38,478 linear feet of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 2,374 acres (including 22,122 linear Feet Of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 1,992 acres (including 22,461 linear feet of Xeroriparian Wash).
Noxious and invasive plant species	Reclamation of several test well sites would reduce the risk of invasion by noxious and invasive plant species.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 198,182-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 184,906-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 178,400-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 171,309-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 10% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.
VISUAL RESOURCES					
Visual contrast	Current landscape in the area is characterized by flat to low desert hills and plains with low vegetative diversity. Existing human modifications in the project area are limited to dirt surface tracks and roads and a single stock pond. Under the No Action alternative, the landscape would continue to be influenced by these factors.	The regular geometric forms and strong horizontal and vertical lines associated with the SSEP would contrast with the irregular, organic forms and colors of the existing landforms and vegetation. In addition, color contrast associated with the reflective solar troughs would vary throughout the day as the mirrors rotate to track the sun. The visual contrasts from the SSEP rank from weak to strong depending on the time of day and viewing location. The solar troughs, when viewed from elevated viewing positions at certain times of the day, would reflect the sky resulting in intermittent bright colors that would sharply contrast with the dull hues of the surrounding tan soils and gray-green vegetation.	Similar to the Proposed Action, except that the use of an ACC in each power block (instead of cooling towers) would result in reduced visual contrast to the irregular forms and lines of the current landscape from KOPs with level views. A reduction in the size of the evaporative ponds would result in less reflective color contrast visible from some KOPs.	Similar to the Proposed Action, except that visual contrasts would occur over a smaller geographic area and be less visible from surrounding KOPs. Contrasts in form, line, and color would diminish more over distance than those under the Proposed Action. 30% fewer solar troughs associated with Alternative B would result in a smaller area of color contrast visible from elevated KOPs.	Similar to the Proposed Action, except that visual contrasts would be less due to the reduction in project footprint. Contrast levels would change from predominantly moderate (with strong contrasts at a few locations) under the Proposed Action to predominantly weak (with moderate contrasts at a few locations) under Sub-alternative A1. Visual changes due to the geometric forms, vertical lines, and concentrated light associated with the SSEP would be the same as under the Proposed Action, except that concentrated light would not be reflected toward any sensitive viewer because PV panels are designed to minimize light reflectance. PV solar arrays would appear to be a dark color when viewed from slightly elevated to superior viewing positions at certain times of the day.
Changes to the visual inventory	No change would occur to the existing visual inventory.	Construction and operation of the Proposed Action would occur exclusively within lands with low visual sensitivity and Class C scenic quality, and in the foreground/middleground distance zone. The Proposed Action may further degrade inventoried scenic quality in the project area due to a stronger presence of cultural modifications, although the Class C designation would remain.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy slightly fewer acres.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy fewer acres.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy fewer acres.
Consistency with BLM VRM objectives	BLM VRM Class IV objectives would continue to be met.	Under all action alternatives, the level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis and would meet BLM VRM Class IV objectives.			

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Night sky conditions	There would be no change to the Bortle Dark-Sky Scale Class V rating.	Under all action alternatives, there would be no change to the Bortle Dark-Sky Scale Class V rating.			
Potential Glint and Glare	No new glint and glare impacts would occur.	The Proposed Action would produce glint and glare that could be visible to the viewing public and would increase contrast for all KOPs with views of the SSEP. However, this increase to contrast would be intermittent or limited to certain times of the day for some sensitive viewers. Sensitive viewers with superior views may be affected by glint and glare throughout the day, because larger portions of the project area would be visible. Contrast associated with glint and glare is anticipated to decrease as distance between the SSEP and the viewer increases. When the solar troughs of the Proposed Action are moving into or out of stow position (shortly before dawn or after dusk), they have the potential to produce glint and glare. For sensitive viewers with unobstructed level views of the SSEP, glint and glare associated with movement times would be generally limited to the first row of solar troughs. Solar troughs have highly reflective surfaces and at certain times of the day would reflect the sky.	Impacts from potential glint and glare would be the same as the Proposed Action.	Potential glint and glare impacts would be the same under Alternative B as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.	Potential glint and glare impacts would be reduced under Sub-alternative A1 when compared to the Proposed Action. Sub-alternative A1 would use PV panels rather than solar troughs. PV panels do not have the same stow position as solar troughs and are designed specifically not to reflect light, reducing potential glint and glare impacts. In addition, the PV panels would have a lower profile than the solar troughs of the Proposed Action, which would also reduce visibility when viewed from level viewing positions. The smaller footprint of this alternative would also reduce glint and glare impacts.
WATER RESOURCES					
Surface Water	No impacts to surface water resources would occur.	Within the solar field, 39.6 linear miles of surface water drainages would be filled and 215 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.	Same as Proposed Action.	Within the solar field, 25.8 linear miles of surface water drainages would be filled and 112 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.	Within the solar field, 19.8 linear miles of surface water drainages would be filled and 1.9 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.
Groundwater use	No changes in the groundwater reserves stored in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.	2,305 to 3,003 acre-feet of produced groundwater would be used annually. Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 69,150 to 90,0902 acre-feet of groundwater at the completion of the project. **Reduced Water Use Option: Brine Concentrator** 2,144 to 2,793 acre-feet of produced groundwater would be used annually with the Brine Concentrator Option (7% less than under the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 64,311 to 83,812 acre-feet of groundwater at the completion of the project.	116 to 151 acre-feet of produced groundwater would be used annually (an approximately 95% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 3,484 to 4,549 acre-feet of groundwater at the completion of the project.	1,518 to 2,003 acre-feet of produced groundwater would be used annually (an approximately 34% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 45,535 to 60,101 acre-feet of groundwater at the completion of the project. **Reduced Water Use Option: Brine Concentrator** 1,412 to 1,863 acre-feet of produced groundwater would be used annually with the Brine Concentrator Option (7% less than under Alternative B). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 42,341 to 55,891 acre-feet of groundwater at the completion of the project.	On average, 65 acre-feet of produced groundwater would be used annually (an approximate 98% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 2,165 acre-feet of groundwater at the completion of the project.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Groundwater drawdown	No changes in the depth to groundwater in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.	Direct impact to the depth-to-groundwater from pumping up to 3,003 afy would result in drawdown in registered wells of up to: • 32 feet in one well, • 30–32 feet in five wells, • 28–30 feet in six wells, • 26–28 feet in four wells, • 24–26 feet in 10 wells, • 22–24 feet in 7 wells, • 20–22 feet in 24 wells, • 18–20 feet in seven wells, • 16–18 feet in 14 wells, • 14–16 feet in 10 wells, • 12–14 feet in eight wells, • 10–12 feet in 17 wells, • 8–10 feet in eight wells, • 6–8 feet in seven wells, • 4–6 feet in 20 wells, and • 2–4 feet in 20 wells. **Reduced Water Use Option: Brine Concentrator** Direct impact to the depth to groundwater was not modeled and is unknown, but expected to be less because this option would reduce water use by approximately 7%.	Direct impact to the depth to groundwater was not modeled and is unknown but expected to be much less than the Proposed Action because this alternative would use approximately 95% less water.	Direct impact to the depth to groundwater was not modeled and is unknown but expected to be less than the Proposed Action because this alternative would use approximately 33% less water. **Reduced Water Use Option: Brine Concentrator** Direct impact to the depth to groundwater was not modeled and is unknown but expected to be less because this option would reduce water use by approximately 7%.	Direct impact to depth to groundwater from pumping 33 afy during operations would result in a maximum drawdown of less than 1 foot in registered wells in the Rainbow Valley aquifer. Maximum depth to groundwater decline of less than 1 foot over the life of the project.
WILDLIFE AND SPECIAL-STATUS SPECIES					
General wildlife	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	A total of 3,600 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, along with 38,540 linear feet of Xeroriparian Wash habitat. Impacts include wildlife displacement; habitat degradation due to human noise and activity and weed invasion; road mortality and road barrier effects; exposure of wildlife to selenium and other potentially toxic constituents in evaporation ponds; and the removal of the CCC stock pond.	A total of 3,590 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (<1% less than under the Proposed Action), along with 38,478 linear feet of Xeroriparian Wash habitat (<1% less than under the Proposed Action).	A total of 2,374 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (34% less than under the Proposed Action), along with 22,122 linear feet of Xeroriparian Wash habitat (43% less than under the Proposed Action). When compared to the Proposed Action, this alternative would retain the CCC stock pond for wildlife use.	A total of 2,013 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (44% less than under the Proposed Action), along with 22,461 linear feet of Xeroriparian Wash habitat (42% less than under the Proposed Action). When compared to the Proposed Action, this alternative would retain the CCC stock pond for wildlife use and reduce the size of the evaporative pond from approximately 90 acres to 1 acre.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Special-status wildlife species	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	Displacement of burrowing owl from breeding habitat in the long term due to project construction and operations. Potential interruption of Sonoran desert tortoise dispersal between suitable habitats. Evaporation ponds and human refuse may attract ravens, which would increase the potential for predation on juvenile desert tortoise populations. Impacts to golden eagles (*Aquila chrysaetos*) would include a loss of foraging habitat if prey species decline and the potential for electrocution on the gen-tie power line. Special-status bat species have the potential for exposure to selenium and other potentially toxic constituents in the evaporation ponds. The removal of the CCC stock pond would reduce available breeding habitat for the Great Plains toad.	Impacts from this alternative would be identical to those described for the Proposed Action.	When compared to the Proposed Action, this alternative would disturb less burrowing owl habitat. Golden eagle prey populations would be impacted to a lesser degree than the Proposed Action due to the reduced footprint. The CCC stock pond would remain as potential breeding habitat for the Great Plains toad.	Impacts from this alternative would be similar to those described for Alternative B.
Wildlife linkages	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	In the Gila Bend-Sonoran Desert National Monument linkage, a total of 8.9 acres of wildlife habitat in Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, including associated xeroriparian wash habitat. In the Buckeye Hills-Sonoran Desert National Monument linkage, a total of 1,149 acres of wildlife habitat in Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, including associated xeroriparian wash habitat. Impacts in these linkages consist of road barrier effects leading to reduced habitat connectivity and potentially reduced genetic exchange between populations. Species active at dusk and dawn, species that use Xeroriparian Wash habitat for movement corridors, and the Sonoran desert tortoise have the highest potential to be adversely affected.	Impacts from this alternative would be identical to those described for the Proposed Action.	Impacts to defined linkages from this alternative would be identical to those described for the Proposed Action. Fewer adverse impacts to wildlife movement outside of defined linkages would result under Alternative B than under the Proposed Action because it retains more desert wash habitat for wildlife movement. This alternative would not impact one of the larger riparian washes along the east side of the Project Area that likely functions as a wildlife travel corridor.	Impacts from this sub-alternative would be the same as those described for the Proposed Action, except that there would be reduced road barrier impacts to wildlife due to fewer vehicle trips. Fewer adverse impacts to wildlife movement outside of defined linkages would result than under the Proposed Action because it would retain more desert wash habitat for wildlife movement. This sub-alternative would not impact one of the larger riparian washes along the east side of the Project Area that likely functions as a wildlife travel corridor.

Note: If the Gen-tie Line Option were selected in combination with any action alternative, the increase in total surface disturbance would be less than 1% in all cases. Impacts as a result of implementing the Gen-tie Line Option are not included under the resource headings in this summary table. Land Use and Access and Vegetation and Special-status Species are two exceptions because the Gen-tie Line Option would affect components of these resources differently than noted here.

CHAPTER 3.
AFFECTED ENVIRONMENT

3 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the existing environment, including the physical environment, natural environment, and human-made resources and uses, which would be affected by the Proposed Action and alternatives.

3.1.1 General Setting of Project Area

The SSEP would be located in the west end of the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills in Maricopa County, Arizona (see Map 1). SSEP facilities would be located almost entirely on public lands administered by the BLM. The proposed footprint of the facilities and anything that lies within the boundaries of this footprint (hereafter referred to as the Project Area) would occupy approximately 3,620 acres (see Map 2). However, when SSEP's potentially affected environmental elements were first assessed, an area of approximately 3,700 acres was assumed. Therefore, some of the acres presented in this chapter are closer to 3,700 acres. This slightly larger figure remains adequate to describe the current environment in and directly adjacent to the Project Area, and for BLM to make a reasoned and informed decision on this proposal.

3.1.2 Sonoran Solar Energy Project Overview

Boulevard proposes to construct a 375-MW solar thermal plant that would include two proposed power blocks (125 MW and 250 MW), a solar field, evaporation ponds, HTF land-treatment areas, and linear facilities. The SSEP would use a parabolic trough, solar thermal technology to produce electrical power using steam-turbine generators fed by solar-steam generators. The SSEP would also use natural gas-fueled boilers or heaters for additional power generation and HTF freeze-protection heaters. The facility would be designed to accommodate the future use of TES. TES would consist of molten salt and a two-tank design, and it would provide three to four hours of storage for the overall facility. The purpose of gas backup and TES systems is to increase daily hours of operation, shift energy production into peak periods, and makeup production during periods of extended cloud cover. The SSEP would consist of two solar thermal power block units. A 125-MW unit would produce approximately 290,000 MWh per year, and a 250-MW unit would generate approximately 580,000 MWh per year. The entire facility would operate for 30 years or more. Boulevard would phase construction so that the 125-MW unit would be operational as soon as approximately one year before the separate 250-MW unit becomes operational. For more detail on the Proposed Action and each of the alternatives, see Chapter 2.

3.1.3 Resources Values and Uses Brought Forward for Analysis

Based on internal (agency and cooperator) and external (public) scoping, or issue identification, a number of issues and concerns were identified for analysis in this EIS (see Chapter 1, Section 1.4.2). In order to analyze and respond to the issues and concerns, the resource values and uses of the affected environment must be identified and described. For this EIS analysis, the following resources and uses are brought forward for analysis and are presented in this chapter.

- Air Quality
- Climate Change
- Cultural Resources
- Geology and Minerals
- Hazardous Materials and Hazardous and Solid Waste
- Land Use and Access
- Livestock Grazing
- Noise
- Paleontology
- Recreation and Wilderness Characteristics
- Socioeconomics
- Soils
- Special Designations
- Transportation and Traffic
- Vegetation and Special-status Plant Species
- Visual Resources
- Water Resources
- Wildlife and Special-status Species

3.1.4 Analysis Area

The analysis area varies by resource value or use, depending on the geographic extent of the resource or use and the extent of the effects of the Proposed Action and alternatives on a resource or use. In some cases the analysis area is the Project Area (e.g., paleontological resources), because that is the extent of the effects of the project on the resource. In other cases the analysis area is much larger, encompassing larger administrative or natural boundaries (e.g., social and economic conditions, or wildlife and habitat), because the effects on the resource extend beyond the Project Area boundary. The analysis area for each resource value or use is defined in the *Overview* section of each resource discussion that follows.

3.2 Air Quality

3.2.1 Overview

The analysis area for air quality is the Maricopa County PM_{10} nonattainment area, which is the regulatory boundary used for air quality assessment in which the SSEP would reside. The area of analysis and the Project Area are shown in Map 8. The analysis area for visibility of plumes from the Project Area is expanded to include Class II wilderness areas and special designation areas that are within 50 kilometers (km) of the Project Area (Farmer 2010). These areas are summarized in Table 3.1.

Table 3.1 Class II Wilderness Areas and Recreational Areas near the Project Area

Area Name (Managing Agency)	From Project Area to Nearest Boundary	
	Approximate Distance in km (miles)	Direction
Sonoran Desert National Monument (BLM)	2.2 (1.3)	Southeast to south
Signal Mountain Wilderness (BLM)	34.3 (21.3)	West-southwest to west
Woolsey Peak Wilderness (BLM)	22.7 (14.1)	Southwest to west
North Maricopa Mountains Wilderness (BLM)	4.9 (3.0)	Southeast
South Maricopa Mountains Wilderness (BLM)	28.2 (17.5)	Southeast
Sierra Estrella Wilderness (BLM)	22.5 (13.9)	East
Estrella Mountain Regional Park (Maricopa County)	13.8 (8.6)	Northeast to east-northeast
White Tank Mountain Regional Park (Maricopa County)	43.5 (27.0)	North
Buckeye Hills Regional Park (Maricopa County)	8.9 (5.5)	Northwest

The primary factors that influence regional air quality in the area of analysis are the locations of air pollution sources, the amounts and chemical characteristics of the pollutants emitted, the topography of the region, and local meteorological conditions.

3.2.2 Local Topography and Climate

The Project Area is located in an arid region of western Maricopa County, Arizona that is surrounded by mountainous terrain; the Buckeye Hills are directly north, and the North Maricopa Mountains are to the south. About 15 miles east from the Project Area, the Sierra Estrella Mountains run in a northwest-southeast direction. The Gila Bend Mountain range extends 20 miles west from the western side of the Gila River Valley. Elevations in the area range from just over 1,000 feet above mean sea level (amsl) along the valley floor to a peak elevation of 3,170 feet at Woolsey Peak approximately 18 miles west of the Project Area.

The mountainous topography surrounding Maricopa County contributes to the occurrence of surface temperature inversions, especially during the winter months. A surface temperature inversion occurs when the air temperature near the ground is cooler than the air temperature above. Surface inversions form because the ground cools faster than the air above. Inversions can hinder air pollutant dispersion by reducing vertical mixing, trapping pollutants close to the ground, thus increasing the concentration of air pollutants such that they may reach unhealthy levels. In areas where the local topography acts to pool and trap cold air (deep valleys surrounded by steep mountains), cold temperatures associated with stationary

or slow-moving, high-pressure systems can last for days or (rarely) weeks and create inversions that result in poor air quality due to the compression of cold air masses and lack of circulation. In Maricopa County, inversions are most severe during the fall and winter. High concentrations of PM_{10} are observed during these conditions (MAG 2008).

Localized, high-pressure systems conducive to high-surface, daytime temperatures frequently form over the desert Southwest. Temperatures in this region are typical of desert climates, ranging from 30°F to 45°F during the winter, to more than 100°F during the summer. Daily temperatures of 90°F or greater occur approximately 40%–50% of the year. During the summer months, maximum temperatures of 120°F or greater have been reported. Precipitation in the region is sparse and is limited primarily to rainfall, although traces of snow, sleet, or hail have been reported. Rainfall occurs primarily during the monsoon months of July and August. During these months, large amounts of warm, moist air moving from the Gulf of Mexico can create heavy thunderstorms across Arizona. There can also be occasional, heavy-winter rainstorms, typically in December through February. Precipitation amounts are minimal in the region during the remainder of the year. Table 3.2 summarizes the mean temperatures and precipitation levels at three locations that characterize the climatology in the locale of the Project Area. Averaging the temperature and precipitation data for these locations yields an average temperature of approximately 71°F and an average precipitation level of approximately 7 inches for the region.

The hot and dry conditions in the region, especially during the summer months, contribute to windblown dust and fugitive dust. Dust storms are a natural phenomenon in the Sonoran Desert; however, they may be exacerbated by land disturbances that disturb soil crusts and/or result in the removal of vegetation.

Prevailing winds in the Project Area are generally easterly and westerly. There is a consistent, almost daily shift in wind direction. Winds blow generally from the east during the morning hours, and then shift to winds from the west in the afternoon. This pattern is apparent in an annual wind rose for the Phoenix Sky Harbor Airport (Figure 3.1) for 2007.

Table 3.2 Climatology Summary: Mean Temperature and Precipitation for Project Area

	Monthly Average Dry Bulb Temperature (°F)			Average Monthly Total Precipitation (inches)		
	Litchfield Park[1]	Buckeye[2]	Gila Bend[3]	Litchfield Park[1]	Buckeye[2]	Gila Bend[3]
Monthly Mean						
January	51.62	51.22	53.86	0.90	0.82	0.61
February	55.88	55.45	57.76	0.97	0.78	0.63
March	60.71	60.43	63.09	0.82	0.75	0.62
April	68.10	67.50	69.93	0.32	0.28	0.22
May	76.73	75.45	78.29	0.13	0.10	0.13
June	85.51	84.15	87.23	0.08	0.07	0.05
July	91.37	90.74	93.60	0.74	0.87	0.73
August	89.56	89.39	92.09	1.23	1.13	1.01
September	83.65	83.04	86.58	0.85	0.77	0.51
October	71.77	70.94	74.70	0.47	0.50	0.39
November	59.51	58.93	61.96	0.64	0.62	0.51
December	52.25	51.56	53.89	1.05	0.90	0.69
Annual Mean						
	70.54	70.08	73.08	8.11	7.70	6.28

Source: Western Regional Climate Center (2009).

[1] Litchfield Park is a suburban community 16 miles northeast of the Project Area. Period of Record of Litchfield Park Climate Summary 8/1/1917 to 4/3/2009.

[2] The Town of Buckeye is a suburban community approximately 10 miles north of the Project Area. Period of Record of Buckeye Climate Summary 3/1/1893 to 11/30/2003.

[3] The Town of Gila Bend is a suburban/agricultural community approximately 8 miles south of the Project Area. Period of Record of Gila Bend Climate Summary 12/1/1892 to 4/3/2009.

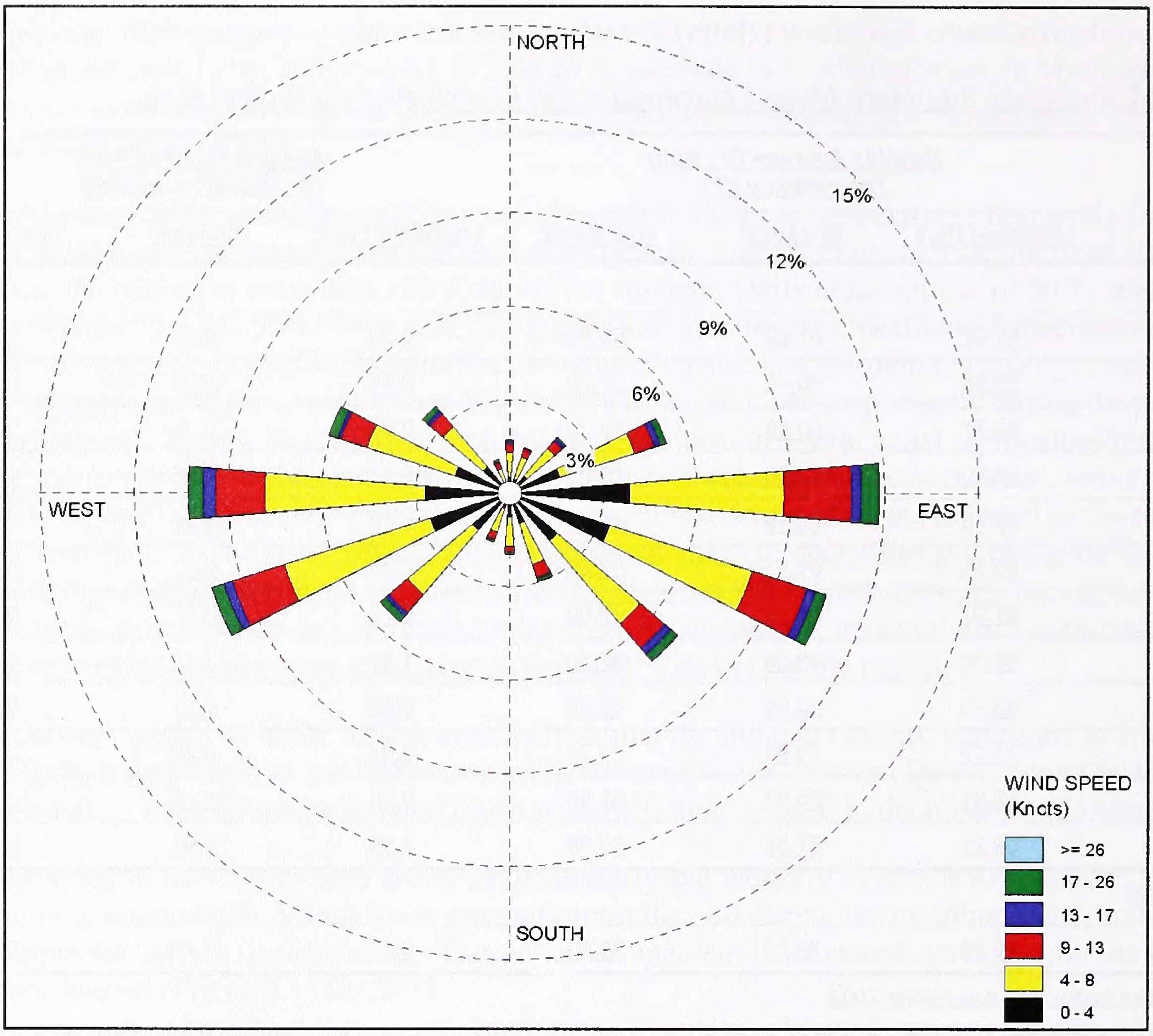

Figure 3.1 Annual wind rose for Phoenix Sky Harbor Airport, 2007.

High summer temperatures, high solar radiation, and emissions from combustion processes (industrial and automotive) contribute to high ozone (O_3) concentrations in the area. O_3 is generally not emitted directly, but forms from a chemical reaction between emissions of volatile organic carbons (VOCs) and nitrogen oxides (NOx) in the presence of heat and sunlight. Sources of VOC emissions are numerous and include automobiles, gasoline stations, and compressor emissions. NOx are emitted from combustion processes in automobiles, power plants, compressors, etc. Although O_3 is produced throughout the year, the highest O_3 concentrations in most urban areas, including the Phoenix metropolitan area, are usually observed in the summer when strong sunlight and high temperatures drive the chemical reactions that form O_3. Stagnant meteorological conditions, such as inversions, can trap the air in the region for several days. O_3 concentrations are generally considered a regional issue. This means that O_3 concentrations in a given area can result from emissions that are transported into the area from distant emissions sources, as well as from local emissions sources.

Atmospheric stability is another important factor of meteorology that contributes to the weather patterns, frequency and intensity of storms, and air pollution concentrations. When the atmosphere is stable, emitted pollutants tend to remain within a few hundred feet of the surface (close to the emission sources), and will begin to diffuse horizontally across the surface. When the atmosphere is unstable, air pollution mixes vertically in the atmosphere and tends to be carried away by the prevailing wind. In south-central Arizona, atmospheric stability varies with the season. The frequency and duration of stable and unstable conditions of the atmosphere are in relative balance during the warmer months. Periods of atmospheric instability are typically manifested in monsoon rain events and dust storms that may occur daily from

early July to early September. When temperatures fall as winter approaches, stability in the atmosphere becomes more prevalent, and mid-latitude, high-pressure conditions tend to be dominant over south-central Arizona and northern Mexico.

3.2.3 Existing Air Quality

3.2.3.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

As directed by the federal CAA, the EPA has established National Ambient Air Quality Standards (NAAQS) for seven "criteria" pollutants (Table 3.3). These standards were adopted by the EPA to protect public health (primary standards) and public welfare (secondary standards). The seven pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), O_3, inhalable particulate matter (i.e., PM_{10}), fine particulate matter (i.e., $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). States are required to adopt standards that are at least as stringent as the NAAQS. The Arizona ambient air quality standards are identical to the NAAQS (40 CFR §50.4–50.16; and A.A.C. Title 18, Chapter 2, Article 2, Sections 201 to 206).

Table 3.3 NAAQS for Criteria Pollutants

Polluant	Averaging Period	NAAQS Level µg/m³ (ppm)*	
		Primary [1]	Secondary
NO_2 [5]	Annual[3]	100 (0.053)	100 (0.053)
CO[6]	1-hour 8-hour	40,000 (35)[2] 10,000 (9)	n/a
PM_{10} [7]	24-hour	150	150
$PM_{2.5}$ [8]	24-hour (Rev. 2006) Annual[2]	35 15	35 15
SO_2	3-hour [3] 24-hour Annual[2]	No standard 365 (0.14) 80 (0.03)	1,300 (0.50)
Pb and its compounds	3-month average	1.5	1.5
O_3 [9]	1-hour (repealed) 8-hour (new) [4]	235 (0.12) 157 (0.075)	235 (0.12) 157 (0.075)

* Standards are in terms of ambient concentration; µg/m³ is "micrograms per cubic meter," ppm= parts per million by volume

[1] Federal and Arizona short-term standards are not to be exceeded more than once per year except in the case of the PM_{10} and O_3. Compliance is determined by the number of days the PM_{10} and O_3 standards are exceeded; the number of days per year, based on a three-year running average, is not to exceed one.

[2] Annual arithmetic mean of hourly readings.

[3] Three-hour average determined as successive, nonoverlapping blocks, starting midnight each day.

[4] EPA standard revised to 0.075 µg/m³as of 2008 (NAAQS 2009).

Sources: 40 CFR § 50.4–50.16; and A.A.C. §§ R18-2-201–R18-2-206.

[5] NO_2 NAAQS attainment is demonstrated if the annual average is below the standard value, based on data that are 75% complete for all annual hours.

[6] CO NAAQS attainment is demonstrated for years in which an 8-hour average concentration exceeding the standard value occurs no more than once per year.

[7] Particulate Matter (PM_{10}) NAAQS attainment is demonstrated for years in which a 24-hour sample concentration exceeding the standard value occurs no more than once per year.

[8] Fine Particulate Matter ($PM_{2.5}$) NAAQS attainment is demonstrated when the annual mean is less than the standard value. $PM_{2.5}$ 24-hour NAAQS attainment is demonstrated for years in which the 98th percentile high sample concentration does not exceed the standard value.

[9] O_3 NAAQS attainment is demonstrated in locations where a three-year mean of the fourth highest occurring 8-hour monitored averages is below the standard value.

3.2.4 Clean Air Act Attainment Status

Based on the adopted air quality standards, the CAA requires that states classify air basins (or portions thereof) as either *attainment* or *nonattainment* with respect to the criteria pollutants. The classifications are defined below.

- **Attainment Area:** This is a geographic or politically delineated air basin that meets the NAAQS for criteria pollutants.
- **Nonattainment Area:** This is a geographic or politically delineated air basin that does **not** meet the NAAQS for one or more pollutants. In nonattainment areas, state or local air pollution control districts are required to formulate and submit SIPs for EPA approval that outline those measures the state will implement to attain and maintain the NAAQS.
- **Serious Nonattainment Area:** All PM_{10} nonattainment areas were initially classified as moderate and were assigned an attainment date of December 31, 1994. A *moderate* nonattainment area can subsequently be reclassified as a *serious* nonattainment area if EPA determines the area cannot "practicably" attain the PM_{10} NAAQS by the attainment date, or following the passage of the original attainment date if EPA determines the area has failed to attain the standard. The Maricopa County nonattainment area was reclassified to *serious* on May 10, 1996 due to failure to attain the particulate standard by December 31, 1994.
- **Unclassifiable:** This is an area that lacks sufficient monitoring data. Unclassifiable areas are conservatively managed as though being in attainment, so as to maintain or improve existing air quality.
- **Maintenance Area:** This is an area that was previously a nonattainment area and that has been demonstrated with recent data to have achieved attainment of the NAAQS.

A particular geographic region may be designated an attainment area for some pollutants, and a nonattainment area for others. The ADEQ has designated all of Maricopa County as being either in attainment or unclassifiable with respect to the NAAQS for SO_2 and NO_2. Progress in regional air quality improvement in recent years has allowed the county to be designated a maintenance area with respect to CO and one-hour O_3 NAAQS. In contrast, most of Maricopa County is a serious nonattainment area for PM_{10}. Further, the ADEQ and EPA have designated nearly all of Maricopa County to be in nonattainment of the more recent NAAQS for 8-hour average O_3 and for both short and long-term NAAQS for $PM_{2.5}$. The status of the local air quality designations is summarized in Table 3.4.

Table 3.4 Attainment Status in the Locale of the Project Area

Pollutant	Attainment Status
NO_2	Unclassifiable/attainment
SO_2	Attainment
CO	Attainment, maintenance plan
PM_{10}	Serious nonattainment
$PM_{2.5}$	Nonattainment
Pb	Unclassifiable/attainment
O_3	One-hour average – attainment; (NAAQS superseded by 8-hour average standard) 8-hour – nonattainment

3.2.4.1 RECENT AIR QUALITY MONITORING DATA AND NAAQS EXCEEDANCES

The ADEQ maintains an ongoing, statewide air monitoring program to characterize air quality in several geographic regions; however, the Project Area itself is not intensely monitored for ambient air quality conditions. Selecting representative, local background monitoring data are consequently not possible for all criteria pollutants. The ADEQ monitors that are closest and most representative of local air quality are located in the Town of Buckeye, and two locations are in west Phoenix (ADEQ 2006, 2007, 2008, and 2009). The NAAQS and Arizona primary and secondary standards are presented in Table 3.5 in addition to the most recent monitoring data available for three locations near the Project Area. The Dysart Road monitor (northwest of Phoenix, near the intersection of U.S. Highway 93 [US-93] and Dysart Road) is located in a mostly residential area surrounded by desert and some agricultural activities, and is approximately 32 miles northeast of the Project Area. The monitor location in west Phoenix (39th Avenue and Earll Street) is in a developed, residential area on the west side of Phoenix, approximately 30 miles northeast of the Project Area. The Dysart Road and west Phoenix monitors are in areas that are more developed than the Project Area, and reflect the influences of urban vehicle traffic. The Buckeye monitor is closest to the Project Area, and is the most representative of the current conditions near the Project Area. This monitor is located just south of the intersection of SR-85 and Baseline Road, approximately 10 miles from the Project Area.

3.2.4.1.1 Particulate Matter

Particulate matter refers to dust and other particles in the air and is measured either as particulate matter that is 10 micrometers and smaller (PM_{10}) or fine particulate matter that is 2.5 micrometers in diameter and smaller ($PM_{2.5}$). $PM_{2.5}$ is a subset of PM_{10}. Sources of PM_{10} in the area of analysis include

- stationary point sources, such as fuel combustion and industrial processes;
- fugitive sources, such as roadway dust from paved and unpaved roads, construction areas, and parking lots;
- wind erosion from disturbed vacant lots, construction sites, and agricultural fields;
- fires; and
- transportation sources, such as automobiles.

Recently, the EPA has implemented revised standards for particulate matter. The PM_{10} regulation was established by the CAA for particulates less than or equal to 10 microns in size. The prior standard for PM_{10} was revised, and new standards were added for particles less than 2.5 microns in size ($PM_{2.5}$). The requirement for agencies to demonstrate attainment of the new standards has affected the current emission standards for combustion and fugitive dust sources.

Table 3.5 Regional Monitoring in the Locale of the Project Area

ADEQ Monitoring Station	Carbon Monoxide, CO (ppm) 8-hr Avg.[1]	Nitrogen Dioxide, NO_2(ppm) Annual Avg.[2]	Ozone, O_3 (ppm) 8-hr Avg.[3]	PM_{10} (µg/m³) Annual Avg.[4]	PM_{10} (µg/m³) 24-hr Avg.[5]	$PM_{2.5}$ (µg/m³) Annual Avg.[6]	$PM_{2.5}$ (µg/m³) 24-hr Avg.[7]
NAAQS Values	**9**	**0.053**	**0.075**	**50** [8]	**150**	**15**	**35**
Monitored Year 2007							
Buckeye	0.8	0.0102	0.064	52.5	166	*	*
Dysart Road	1.3	*	0.065	35.9	94	*	*
W. Phoenix	4.1	0.0209	0.074	47	116	10.9	27.2
Monitored Year 2006							
Buckeye	0.6	0.0111	0.067	53	192	*	*
Dysart Road	0.8	*	0.072	32.3	55	*	*
W. Phoenix	4.6	0.0238	0.082	49.8	122	13.5	28.8
Monitored Year 2005							
Buckeye	0.9	0.0119	0.065	52.7	158	*	*
Dysart Road	1.2	*	0.066	29	68	*	*
W. Phoenix	4.6	0.0235	0.068	44.5	103	12.9	40.5
Three-year Mean Averages Used for NAAQS Conformance							
Buckeye	*	*	0.065	*	*	*	*
Dysart Road	*	*	0.067	*	*	*	*
W. Phoenix	*	*	0.075	*	*	*	*

Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006. The same monitored parameters are shown in the same numbered tables for each report year.

Notes: ppm = parts per million.

µg/m³= micrograms per cubic meter.

* No available data.

[1] CO data given as the 2nd highest occurring 8-hour average for the reporting year (ADEQ Annual Reports, Table 13). NAAQS attainment is demonstrated for years in which an 8-hour average concentration exceeding the standard value occurs no more than once per year.

[2] NO_2 data given as the annual mean average of hourly readings (ADEQ Annual Reports, Table 6). NAAQS attainment is demonstrated if the annual average is below the standard value, based on data that are 75% complete for all annual hours.

[3] O_3 data are given as the 4th highest occurring 8-hour average for the reporting year (ADEQ Annual Reports, Tables 9 and 23). NAAQS attainment is demonstrated in locations where a 3-year mean of the 4th highest occurring 8-hour monitored averages is below the standard value.

[4] Particulate Matter (PM_{10}) annual data are given as the annual mean concentration from samples at the monitored location (ADEQ Annual Reports, Table17). NAAQS attainment is demonstrated when the annual mean is less than the standard value.

[5] Particulate Matter (PM_{10}) 4-hour data are given as the 2nd highest occurring sample concentration during the reporting year at the monitored location (ADEQ Annual Reports, Table 10). NAAQS attainment is demonstrated for years in which a 24-hour sample concentration exceeding the standard value occurs no more than once per year.

[6] Fine Particulate Matter ($PM_{2.5}$) annual data are given as the annual mean concentration from samples at the monitored location (ADEQ Annual Reports, Tables 11 and 19). NAAQS attainment is demonstrated when the annual mean is less than the standard value.

[7] Fine Particulate Matter ($PM_{2.5}$) 24-hour data are given as the 98th percentile high sample concentration during the reporting year at the monitored location (ADEQ Reports, Table 20). NAAQS attainment is demonstrated for years in which the 98th percentile high sample concentration does not exceed the standard value.

[8] The 24-hour PM_{10} NAAQS was superseded by the $PM_{2.5}$ short-term standard. ADEQ monitoring still tracks data in comparison to this standard.

Despite adoption of stringent measures and best available control measures, the Maricopa County nonattainment area failed to attain NAAQS for particulate matter by the extended deadline of December 31, 2006 (Maricopa County Air Quality Department [MCAQD] 2010a). This failure triggered a special requirement under the CAA (Section 189(d)) that calls for annual reductions of PM_{10} of not less than 5% of the most recent emissions inventory, until NAAQS is attained. As a result, Maricopa County has adopted more stringent regulations to reduce dust emissions from unpaved roadways, unpaved parking lots and other areas, and construction projects.

PM_{10} concentrations are measured at the ADEQ pollutant monitoring stations listed in Table 3.5. The data from the Buckeye station (the location closest to the Project Area) are consistent with the designation of the PM_{10} nonattainment area that includes those monitoring stations. Data from west Phoenix are very close to the PM_{10} NAAQS; however, data from Dysart Road are well below the standard. Exceedances of the 24-hour PM_{10} NAAQS have occurred at the Buckeye monitoring station between two and four days per year (between 2005 and 2008). Contributing factors to PM_{10} formation and concentrations include temperature inversions during the fall and winter, stagnant air masses, high winds (primarily in the summer), and fine desert soils that are more easily erodible (MAG 2007a; MAG 2008). Windblown dust is an important source of PM_{10} at wind speeds of 6 miles per hour (mph) and greater for the Durango Complex and at wind speeds of 14 mph and greater at the West 43rd street monitor (MAG 2008). The absence of low PM_{10} data points above these wind speed thresholds is evidence of the effect of wind on blowing dust and PM_{10} concentrations (see page 35 and Figures 3-15 and 3-16 in MAG 2008). All NAAQS exceedances recorded at the Buckeye monitoring station in 2005, 2006, 2007, and 2008 occur on days when maximum hourly wind speed at the Phoenix Harbor Airport and the city of Goodyear exceed 6 mph and at least two-thirds of the data exceed 14 mph (Table 3.6). However, temperature inversion is a related contributing factor to the NAAQS exceedances observed during winter months at the Buckeye monitoring station (MAG 2008). The exceedance on July 4, 2008, is likely to be at least partly associated with emissions from fireworks on that day (Table 3.6).

3.2.4.1.2 Ozone

O_3 is not emitted directly into the atmosphere from emission sources. Rather, it is produced through photochemical (light catalyzed) reactions in the atmosphere involving hydrocarbons and NO_x, known generically as "O_3 precursors." Because O_3 formation results from large-scale, atmospheric processes, O_3 formation and transport is more of a regional concern, and is not directly associated with individual, localized sources of pollution.

As listed in Table 3.5, all of the mean annual data for the Buckeye and Dysart Road stations are below the 8-hour O_3 standard of 0.075 ppm. The data for these sites are, however, close to the NAAQS. The highest average annual O_3 concentration for the west Phoenix station is 0.082 ppm; however, the three-year average used for NAAQS conformance at this station is the same as the standard of 0.075 ppm. Additional O_3 formation in the area would therefore contribute to future NAAQS exceedances.

Table 3.6 Exceedances of PM_{10} 24-hour NAAQS at Buckeye Monitoring Station and Paired Wind Data

Date	Buckeye Monitoring Station 24-hr Average PM_{10} ($\mu g/m^3$)	Maximum Hourly Wind Speed (mph) at Sky Harbor Airport	Maximum Hourly Wind Speed (mph) at City of Goodyear
06/21/2005	158.0	11.1	8
07/17/2005	152.6	15.0	18.1
11/18/2005	169.7	20.7	26.5
02/13/2006	159.7	11.5	11.5
02/14/2006	272.9	8.1	9.2
02/15/2006	151.3	20.7	23.0
02/17/2006	191.9	10.4	11.5
04/14/2006	212.0	31.1	28.8
04/12/2007	152.5	34.5	23.0
07/19/2007	195.0	33.4	17.3
11/15/2007	166.3	20.7	17.3
03/02/2008	160.2	21.9	23
06/04/2008	204.0	24.2	23
07/01/2008	172.8	31.1	23
07/04/2008	223.8	10.4	28.8
11/09/2008	147.9	25.3	25.3
	Average Daily Maximum Wind Speed	20.6	19.8
	Percentage over 6 mph	100%	100%
	Percentage over 14 mph	69%	75%

Note: $\mu g/m^3$ is micrograms per cubic meter.

3.2.4.1.3 Carbon Monoxide

CO is an odorless, invisible gas usually formed as the result of incomplete combustion of organic substances. The primary sources of CO are motor vehicles and stationary combustion sources. Secondary sources include aircraft emissions and agricultural and/or forest burning. CO is more of a localized pollution issue, due to its ability to react in the atmosphere under normal conditions. However, during those periods when the air is stagnant, such as with a ground-based inversion, local levels of CO can increase. In western Maricopa County, observed levels of CO tend to be highest during the winter months when inversions are more frequent.

Atmospheric levels in the analysis area are generally well below the NAAQS for CO, especially because this portion of the county is removed from the extensive vehicular traffic associated with urban areas. As listed in Table 3.5, the monitored average values at the Buckeye, west Phoenix, and Dysart Road stations reflect the designation as an attainment area for the CO NAAQS.

3.2.4.1.4 Sulfur Dioxide

SO_2 is formed during the combustion of sulfur-bearing materials, such as the sulfur in metal ores or fossil fuels. In the library of air quality data reviewed in Maricopa County, SO_2 data are sparse. After the closest copper smelter in Ajo, Arizona was closed in 1985, SO_2 ambient concentrations decreased dramatically

(EPA 2003), and monitoring was discontinued. Levels of SO_2 in the area of analysis are expected to be very low due to the lack of major sources.

3.2.4.1.5 Nitrogen Dioxide

NO_2 and nitric oxide (NO) are the two prevalent forms of NO_X that are emitted as air pollutants. Both forms of NO_X are generated by combustion processes, and NO can be converted to NO_2 by atmospheric oxidation reactions. The NAAQS are specific to NO_2, although total NO_X is usually quantified for emission sources. Like CO and SO_2, levels of NO_2 in the Project Area are expected to be well below the NAAQS, based on data from the monitoring stations in the analysis area. Levels of NO_2 obtained for 2005–2007 at the closest monitoring station in the Town of Buckeye (see Table 3.5) were well below the respective standard. The monitoring station in the more urban setting of west Phoenix also exhibited annual averages below the NAAQS. All areas in the analysis area are in the designated attainment area for the NAAQS established for NO_2.

3.2.4.1.6 Lead

The main sources of Pb emissions are 1) vehicles operating in the analysis area that are fueled with leaded gasoline and 2) any existing Pb smelters in the area. Because no Pb smelters and very few vehicles using leaded fuel remain in Maricopa County, levels of atmospheric Pb are essentially nondetectable and historically well below the NAAQS. Data on Pb emissions are not collected at the monitoring stations located in or near the Project Area.

3.2.5 Visibility

Visibility is "the clarity with which distant objects are perceived" (EPA 2001), and is affected by pollutant concentrations, plume impairment, regional haze, relative humidity, sunlight, and cloud characteristics. In the western states, a typical visual range without any human-made air pollutants would be about 140 miles (EPA 2001). Atmospheric visibility is affected by numerous other factors in an urbanized area located in an arid desert. Certain air pollutants, such as nitrates and sulfates, create a long-lasting, visible haze that can be caused by the interaction of pollutant emissions and by photochemical reactions. Windblown dust from disturbed areas, such as construction sites and agricultural areas, can cause impaired visibility over a shorter timeframe. Different particles and chemical species have differing "extinction efficiencies," that is, the ability to block and obscure transmission of light. Optical methods of visibility monitoring track the level of light scattering or extinction. The unit of measurement is the "inverse megameter" (Mm^{-1}), which can be translated into the "visual range" parameter in miles; a more familiar unit that generally indicates the clear view distance from the measurement location.

ADEQ operates an optical observation station for urban haze at the Estrella Mountain Regional Park, approximately 16 miles west-northwest of the Project Area (ADEQ 2008). To provide context for the analysis of visible plumes in this study, Table 3.7 summarizes the available visibility data in both Mm^{-1} and visual range from this monitoring station.

Table 3.7 Regional Visibility Conditions

Monitored Year	Estrella Mountain Regional Park-Nephelometer Measurements[1]					
	Mean of 20% Highest Impaired Hours		Mean of All Sampled Hours		Mean of the 20% Least Impaired Sampled	
	Mm^{-1}	Visual Range[2] (miles)	Mm^{-1}	Visual Range[2] (miles)	Mm^{-1}	Visual Range[2] (miles)
2005	76	32	35	69	12	202
2006	50	49	23	16	7	347
2007	48	51	21	116	5	486

Source: ADEQ (2008).

[1] Nephelometric measurements track the loss of light transmission across a known distance, and are measured in units of Mm^{-1}.

[2] Conversion of Mm^{-1}data to visual range uses the formula: Range (miles) = 2,431/Visibility Value (Mm^{-1}).

3.2.6 *Emissions Status*

3.2.6.1 2005 MARICOPA COUNTY EMISSIONS INVENTORY

MCAQD assembles a comprehensive emission inventory for Maricopa County every three years. The most recent compilation in 2005 illustrates the air pollutant emission levels for which the MCAQD gathers data. These data are divided into various source categories:

- Point Sources: Stationary sources that emit a significant amount of pollution into the air such as power plants, industrial processes and large manufacturing facilities.
- Area Sources: Consist of smaller sized, residential and commercial combustion, manufacturing processes not vented to stacks, dust from earthmoving, landscaping, and windblown dust
- Nonroad Mobile Sources: Consist of exhaust emissions from construction, mining and agricultural equipment, and vehicles that do not travel on highways
- Onroad Mobile Sources: Consist of exhaust emissions and fugitive dust associated with vehicles traveling on roads (paved and unpaved)
- Biogenic Sources: Consist of emissions from plants, including crops, indigenous vegetation, and landscaping

Table 3.8 summarizes point sources, area sources, nonroad mobile sources, onroad mobile sources, and biogenic sources. On road vehicle emissions contribute the largest portion of gaseous pollutants to total county air pollutant emissions. Area sources contribute the largest portion of particulate to total county particulate emissions.

Table 3.8 Maricopa County Emissions Inventory for 2005

Emission Source Category	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)	Nitrogen Oxides, NO_x (tons/yr)	VOCs (tons/yr)	Carbon Monoxide, CO (tons/yr)	Sulfur Oxides, SO_x (tons/yr)
Point sources[1]	1,636.3	939.0	1,995.4	3,866.9	1,248.4	244.5
Area sources[2]	174,611.5	74,331.3	6,801.3	66,005.4	546,509.5	435.2
Nonroad mobile sources[3]	2,120.3	1,992.6	28,604.7	15,873.1	216,784.9	760.5
Onroad mobile sources[4]	25,347.0	2,352.0	66,187.0	51,646.2	558,250.3	1,611.0
Biogenic sources[5]	–	–	3,321.0	90,819.3	12,345.8	–
Total MCAQD inventory (2005)	**203,715**	**79,615**	**106,909**	**212,337.7**	**1,118,354.03**	**3,051.2**

Source: MCAQD (2007).

[1] Total point sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-1).

[2] Total area sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory, 2005 for Table 1.6-3).

[3] Total nonroad mobile sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-5).

[4] Total onroad mobile sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-7).

[5] MCAQD only reports the NOx emissions from biogenic sources. (MCAQD Periodic Emission Inventory for 2005, Table 1.6-9).

3.2.6.2 PERMITTED AIR POLLUTANT SOURCES NEAR THE PROJECT AREA

There are several facilities near the Project Area that have county air permits. Pertinent information on each facility is summarized in Table 3.9. Each facility is considered a minor source, based on their permitted emission limits that are at or below major source thresholds, and based on their actual emissions that are below county significance levels. However, due to applicable federal rules, landfill facilities are required to obtain Title V Major Source permits. The City of Phoenix Municipal Landfill, located west of SR-85 and approximately 7 miles south of the Project Area, is in a relatively early phase of development, and its emissions are predominantly PM_{10}. Wesco Minerals is just 1 mile from the Project Area boundary, and its largest emissions are of NO_X (combination of NO and NO_2) and PM_{10} from silica processing. The Lewis State Prison complex is approximately 2 miles southwest of the Project Area. This facility houses several combustion pollutant sources that contribute emissions of NO_X, CO, and VOC. The Southwest Regional Landfill is located approximately 1.5 miles southwest of the Project Area and contributes similar emission sources as the City of Phoenix Landfill.

Table 3.9 Permitted Facilities and Existing Emissions in the Project Vicinity

Facility Name/Type of Permit and Number	Distance and Direction	Processes Present[1]	Permitted Annual Emissions[2] (Tons/yr)	Recent Actual Emissions[3 a,b] (Tons/yr)	Maricopa County Significance Level[d]
SW REG Municipal Solid Waste Landfill/MCAQD Title V Permit Number V97-023	Approximately 1.5 miles SW	Construction vehicle traffic on paved/unpaved roads, cover operations, landfill gas flaring, stationary IC engines, fuel storage tanks	NO_X = 25 CO = 100 PM_{10} = 25 SOx = 25 VOC = 25	NO_X = 18.2 CO = 3.86 PM_{10} = 17.0 SOx = 1.33 VOC = 1.42	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
City of Phoenix SR-85 Landfill/MCAQD Title V Permit Number V03-002	Approximately 7 miles SW	Construction vehicle traffic on paved/unpaved roads, cover operations, landfill gas flaring, stationary IC engines, fuel storage tanks	NO_X = 25 CO = 68.3 PM_{10} = n/a SOx = 2.3 VOC = 76	NO_X = 1.83 CO = 1.02 PM_{10} = 17.7 SOx = 0.72 VOC = 0.05	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
WESCO Minerals, LLC./MCAQD Non-Title V Permit Number 050042	Approximately 1 mile NE	Stone quarrying/processing including, crushing, screening, material transfer/conveying, surge piling/forming, bagging, and truck load out, emergency diesel generator, propane dryer	NO_X = 38.5 CO = 9.96 PM_{10} = 2.55 SOx = 1.18 VOC = 0.83	NO_X = 24.5 CO = 3.28 PM_{10} = 3.60 SOx = 0.38 VOC = 0.34	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
ASPC-Lewis and SW REG Juvenile Correctional Complex/ MCAQD Non-Title V Permit Number 980078	Approximately 2 miles W	Emergency generators, natural gas generators, fuel burning equipment, aboveground gasoline storage	NO_X = 24.4 CO = 8.99 PM_{10} = 0.82 SOx = 0.21 VOC = 4.93	NO_X = 8.52 CO = 4.28 PM_{10} = 0.15 SOx = 0.07 VOC = 3.08	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40

Source: MCAQD (2009).

[1] Significant process types reported on MCAQD air permit application or inventory.

[2] Maximum allowable emissions, from most recent MCAQD air permits for the facilities.

[3] Reported annual emissions from most recently available MCAQD emission inventory.

[a] Juvenile Correctional Complex actual emissions based on the 2005 MCAQD Emissions Inventory (most recent per MCAQD).

[b] Remaining facilities actual emissions based on the 2008 MCAQD Emissions Inventory.

[c] No allowable emission limitation specified for PM_{10} except for fugitive dust emissions not to exceed 20% opacity.

[d] MCAQD Regulation II, Rule 100, Section 200.99.

3.3 Climate Change

3.3.1 Overview

Climate change refers to shifts in Earth's long-term (decades to millennia) weather patterns as a result of changes in the amount of solar energy Earth receives and changes to the concentrations of GHGs in Earth's atmosphere. A GHG is a gas that traps heat when emitted into Earth's atmosphere. GHGs can be emitted when fuels are combusted, vegetation combusts or decays, or when they simply leak into the atmosphere. Increasing atmospheric concentrations of GHGs are leading to an increase in Earth's average temperature and associated changes in Earth's climate and weather patterns. These changes in Earth's climate are happening at the global level and include increasing temperature levels, rising sea levels, increasing severity of drought events, and increasing severity of precipitation events and storm surges. These trends are global in nature and there are regional variations (for example, one region may see increased precipitation levels, whereas another may see reduced precipitation levels) (Karl, T.R., et al. 2009).

The SSEP relates to climate change in a three-tiered manner. The first tier relates to existing Project Area vegetation. The second tier relates to the emissions intensity of existing grid electricity, and focuses on the relevant portion of the national electrical grid. The national electrical grid is split into 26 sub-regions (Figure 3.2). The SSEP would be located in the Arizona New Mexico (AZNM) sub-region. The third tier relates to the regional temperature and precipitation climate characteristics of the Project Area, defined by existing data from communities surrounding the Project Area.

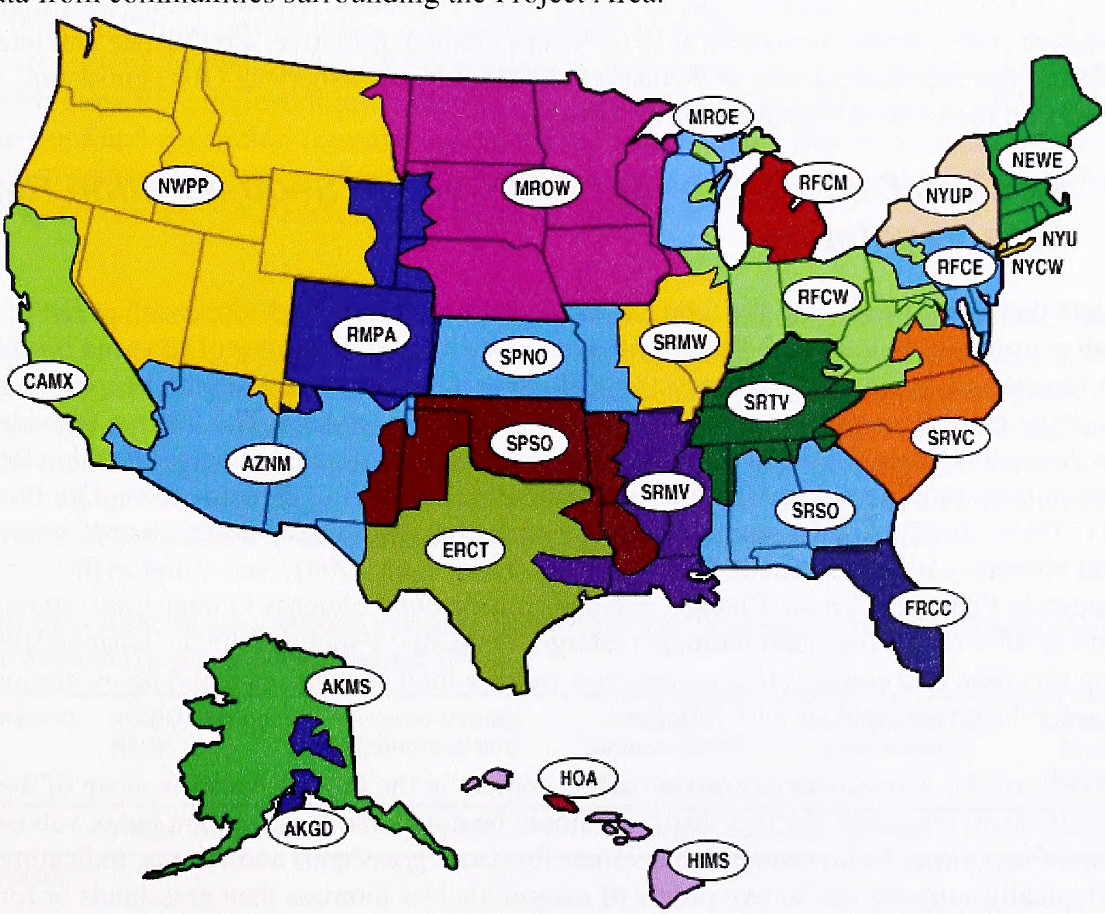

Figure 3.2 Map of EPA Emissions and Generation Resource Integrated Database subregions (EPA 2008).

3.3.2 Laws, Ordinances, Regulations, and Standards

The Project Area is located in an area that falls under the air permitting and jurisdiction of MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal requirements.

However, one rule of particular applicability to GHG emissions and climate change is 40 CFR § 98 (Reporting of GHG Emissions). For the combustion processes at the SSEP facility, this very recent rule requires annual monitoring, recordkeeping, and reporting of GHG emissions. In addition to the CO^2 emissions that are tracked under 40 CFR § 75 (federal Acid Rain Program) this rule requires the calculation of nitrous oxide (N_2O) and methane (CH_4) emissions. The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

3.3.2.1 GREENHOUSE GAS EMISSIONS

The State of Arizona is committed to the reduction of GHG emissions as a means of limiting the influence of human activities on climate change. In September 2006 the governor enacted Executive Order (EO) 2006-13, which set the goal of reducing statewide GHG emissions to year 2000 levels by the year 2020, and to 50% below the 2000 level by 2040. Further, the state is a member of the Board of Directors for the Climate Registry, a nonprofit collaboration among North American states, provinces, territories, and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify, and publicly report GHG emissions into a single registry; supporting both voluntary and mandatory reporting programs and providing comprehensive, accurate data to reduce GHG emissions. Arizona, along with California and most western states, is also a member of the Western Climate Initiative, a multistate and international program promoting a regional cap and trade market to reduce North American GHG emissions, with a particular focus on the western region of North America.

3.3.3 Existing Carbon Content and Carbon Sequestration Rate of Area Vegetation

Published data that offer insight into the total carbon content of desert vegetation, such as the creosotebush community found in the Project Area, are very limited; the focus of research is on the more carbon-rich forests and tropical jungle ecosystems. However, two recent studies can be used to generate an estimate of the carbon content per acre of vegetation in the Project Area. The Carbon Dioxide Information Analysis Center (CDIAC) provides an average value of total aboveground and belowground biomass carbon from satellite imagery studies for "temperate desert" of 1.5 metric tons of carbon/acre (MtC/acre) (CDIAC 2007). A 2008 study in China identified a comparable "desert steppe" ecosystem aboveground biomass carbon content of 2.68 MtC/acre (Long et al. 2008). According to the Intergovernmental Panel on Climate Change, average belowground biomass in temperate regions can range as high as 46% of aboveground biomass (Intergovernmental Panel on Climate Change [IPCC] 2006). Using this ratio as a conservative assumption yields a total aboveground and belowground biomass carbon value for "desert steppe" of 3.91 MtC/acre.

For the purposes of this assessment of current carbon content in the Project Area the mean of these two values (2.7 MtC/acre) was used (Farmer 2010). It should be noted that these carbon index values are one to two orders of magnitude below comparable values for dense grasslands and forests, indicating that desert land typically supports one to two orders of magnitude less biomass than grasslands or forested land.

Published data regarding the carbon sequestration rate of desert vegetation are even more limited than carbon content information. As plants grow, they consume CO^2 from the atmosphere and use the carbon to build their tissues. Data on carbon sequestration rates of desert vegetation could not be obtained. However, if the assumption is made that carbon sequestration rates scale with carbon content, then a comparison can be made between the carbon content of forest land, the carbon content of desert land, and the carbon sequestration rate of forest land. EPA states that the carbon sequestration rate of forest land can be as high as 1.1 MtC/acre/year (EPA 2006a). The CDIAC states that "Tree Cover" (i.e., forest land) has a typical carbon content of 28 MtC/acre (CDIAC 2007). Assuming a linear relationship between carbon content and carbon sequestration rate, desert land carbon sequestration rate is estimated to be 0.06 MtC/year.

The information and assumptions made in this section are not actual measurements of Project Area vegetation characteristics or of the characteristics of the particular vegetation communities found in the Project Area. They represent the best information available to estimate the carbon content and carbon sequestration rate of Project Area vegetation in the face of limited data.

3.3.4 Existing Emissions Intensity of Grid Electricity

Power plants within the existing electrical grid generate GHGs as they produce electricity. The amount of GHGs generated per unit of electricity produced is referred to as the "emissions intensity" of the grid electricity; for example 1,000 pounds CO_2 equivalents per MWh of electricity. The emissions intensity of existing grid electricity is useful in estimating the grid GHG emissions displaced by the SSEP under all action alternatives.

Regarding the GHG emissions intensity of existing local grid electricity, it is most relevant to examine the emissions intensity of the appropriate EPA Emissions & Generation Resource Integrated Database (eGRID) subregion. EPA defined these subregions to represent portions of the power grid that have similar emissions and generation-resource mix characteristics, and that may be partially isolated by transmission constraints. However, these subregions also reflect the interconnected nature of the electrical grid, which spans county, state, and other geopolitical boundaries.

The Project Area is located in the AZNM Western Electricity Coordinating Council (WECC) southwest subregion (see Figure 3.2). According to EPA (EPA 2008), electricity generation resources in this subregion consist primarily of coal (46% of total generation), natural gas (32%), nuclear (16%), hydro (4%), and geothermal (2%). Renewable energy sources such as hydro, geothermal, wind, and solar make up 6% of the total subregion generation mix, with solar in particular contributing 0.0086% of total generation. Total annual electricity generation in this subregion is 157,546 gigawatt hours (GWh). GHG emissions rates for the AZNM WECC southwest subregion are given in Table 3.10.

Table 3.10 EPA Arizona New Mexico Western Electricity Coordinating Council Southwest eGRID Subregion Annual Output GHG Emissions Rates

eGRID Subregion Acronym	eGRID Subregion Name	Carbon Dioxide (pounds/MWh)	Methane (pounds/GWh)	Nitrous Oxide (pounds/GWh)	Carbon Dioxide Equivalents (pounds/MWh)
AZNM	WECC Southwest	1,311.05	17.45	17.94	1,317.98

Source: EPA (2008).

3.4 Cultural Resources

3.4.1 Overview

A cultural resource is generally defined as a phenomenon associated with prehistory, historical events, or individuals or extant cultural systems. These include archaeological sites, districts, and objects; standing historic structures, districts, and objects; locations of important historic events; and places, objects, and living or nonliving things that are important to the practice and continuity of traditional cultures. Cultural resources may involve historic properties, traditional use areas, and sacred resource areas. Further, cultural resources are nonrenewable scientific and educational resources that are protected by federal and state statutes, as summarized in Table 3.11.

Table 3.11 Federal and State Laws and Regulations for Cultural Resources

Law/Regulation	Description/Summary
Antiquities Act of 1906, 16 U.S.C. §§ 431–433	Established the early framework for federal protection of cultural resources. It authorized permits for legitimate archeological investigations and penalties for persons taking or destroying antiquities without permission.
Archaeological Resources Protection Act of 1979,16 U.S.C. §§ 470aa–470mm	Provides additional protection of archaeological resources from vandalism and unauthorized collecting on federal and Indian lands. Section 4 of the statute and Sections 16.5–12 of the uniform regulations describe the requirements that must be met before federal authorities can issue a permit to excavate or remove any archaeological resource on federal or Indian lands.
National Historic Preservation Act, 16 U.S.C. §§ 470x–6	Established the Advisory Council on Historic Preservation (ACHP), SHPOs, NRHP, and Section 106 review process. NRHP: The nation's official list of districts, sites, buildings, structures, and objects worthy of preservation. The NRHP is overseen by the National Park Service. To be eligible for listing in the NRHP, a property must meet at least one of four criteria plus have sufficient integrity. The eligibility is established through the Section 106 process. Section 106: Section 106 of the National Historic Preservation Act (NHPA) mandates a review process for all federally funded and/or permitted projects that will impact sites listed in, or eligible for listing in, the NRHP. It allows interested parties an opportunity to comment on projects. The main purpose of the Section 106 review process is to minimize potential harm and damage to historic properties. Section 106 is initiated by the federal agency that is either conducting the project or that has jurisdiction. If the project is <u>determined</u> to have no adverse effect on eligible historic resources, the applicable agency is required to document this. <u>Consultations with SHPO, Indian tribes, local government, project applicants, and interested citizens are an important aspect of Section 106 compliance through all steps of the process, as follows: identifying historic properties and evaluating their NRHP eligibility; determining if the undertaking will have an adverse effect; and developing actions to avoid, minimize, mitigate, or otherwise resolve adverse effects. Such actions are typically formalized in an agreement document developed in consultation with the consulting parties.</u> <u>Section 110: Section 110 of the NHPA states that activities related to historic preservation are to be carried out in consultation with other federal, state, and local agencies; Indian tribes; and the private sector.</u>
EO 11593, May 13, 1971, 38 *Federal Register* 8921	Requires federal agencies to administer cultural properties under their control and direct their policies, plans, and programs so that federally owned sites, structures, and objects of historical, architectural, or archeological significance are preserved, restored, and maintained. Federal agencies were required to locate, inventory, and nominate to the NRHP all properties under their jurisdiction or control that appear to qualify for listing in the NRHP (ACHP 2009).
Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001–3013	Provides for ownership of Native American graves and objects of cultural inheritance on federal lands. Assigns ownership and disposition of Native American graves, associated artifacts, and items of special cultural significance to appropriate Native American groups. Applies directly to all federal lands or federal undertakings.

Table 3.11 Federal and State Laws and Regulations for Cultural Resources

Law/Regulation	Description/Summary
American Indian Religious Freedom Act, P.L. 95-341; 42 U.S.C. § 1996	Establishes a national policy to protect the right of Native Americans and other indigenous groups to exercise their traditional religions.
EO 13007, Indian Sacred Sites	Designed to protect, when practical, access to Native American sacred sites on federal land.
NEPA	Requires the assessment of potential impacts of a federal action to the human environment, which includes cultural resources.

In the context of the 1966 NHPA, as amended, historic property means any prehistoric district, site building, structure, or object included in or eligible for inclusion in the NRHP. The definition also includes artifacts, records, and remains that are related to such a district, site, building, structure, or object. Historic property also includes properties of religious and cultural importance to an Indian tribe that meet the NRHP criteria. Traditional use area refers to an area identified by a cultural group to be necessary for the perpetuation of the traditional culture. The concept can include areas for the collection of food and nonfood resources, occupation sites, and ceremonial and/or sacred areas. Sacred sites apply to traditional sites and places that Native American tribes or groups, or their members, perceive as having religious significance. Traditional cultural properties (TCP) and sacred sites may be represented by landforms or visual landscapes that continue to be reflected and used by Indian tribes in their cultural practices. These types of resources may be eligible for the NRHP.

In accordance with Section 106 of the NHPA, cultural resources were identified and evaluated within an 8,646-acre survey area that encompasses the Project Area (Map 9). This survey area is the cultural resources analysis area and corresponds directly to the cultural resources APE, which is used in the Section 106 process to consider where direct or indirect effects could occur as a result of implementation of the SSEP (see Map 9). These terms are used interchangeable in the final EIS. No agencies or tribes identified any specific locations of cultural or archaeological significance beyond the APE that could be affected by visual impacts of the proposed project.

3.4.2 Pre-existing Disturbances

The Project Area has been subject to various impacts that have had a direct bearing on the current integrity of cultural resources in the area. Activities such as livestock grazing, primary and secondary dirt roads, fence lines, gas pipelines, and power pole installation and upkeep either have had a direct negative impact through ground disturbance or have encouraged an increase in soil erosion, which damages a site's integrity by displacing artifacts and damaging features. Master plat records at the BLM LSFO also indicate that in 1968, more than 250 hectares (617.8 acres) of the surveyed area were subject to furrowing (which has the same effects as the activities discussed above) to encourage grass and annual growth for cattle forage (BLM 2009b).

3.4.3 Culture History

The following culture history presents a context for the discussion of the cultural resources found in the Project Area, as well as areas of tribal concern. Cultural resources in Arizona are varied in their associations with certain periods and peoples. The following discussion is designed to aid in the interpretation and understanding of the cultural resources found during the survey. In addition, the Native American groups discussed in the Ethnohistoric Period section (Section 3.4.3.4) correspond to the tribes who are being consulted as part of the Section 106 process.

The culture history of the southwestern United States is ordinarily discussed in terms of five divisions that broadly equate to changing adaptations or lifeways (Swanson 2009). The divisions include Paleoindian (Section 3.4.3.1), Archaic (Section 3.4.3.2), Prehistoric Ceramic (Section 3.4.3.3), Ethnohistoric (historic aboriginal) (Section 3.4.3.4), and Historic (historic Euro-American) (Section 3.4.3.5). This summary is adapted from several earlier studies, especially Bruder and Hill (2000), Bruder et al. (2001), and Rogge et al. (2000).

3.4.3.1 PALEOINDIAN PERIOD

The Paleoindian period generally dates from about 10,000 to 6000 B.C. and is identified by the presence of large, often fluted, projectile points, although evidence of such a culture is scarce in the region. Fluted projectile points were recovered from the earliest strata at Ventana Cave and are thought to date to about 9000 to 10,000 years ago. A single Paleoindian projectile point was recovered along the Gila River in the Painted Rocks Reservoir area (Whittlesey et al. 1994). According to Bruder et al. (2001), several points have been located in the interior desert south of Gila Bend on the Barry M. Goldwater Range.

3.4.3.2 ARCHAIC PERIOD

The extinction of Pleistocene large animals is believed to be a contributing factor in the shift from the Paleoindian to the Archaic period, in which the hunting of the large animals gave way to an economy based on hunting smaller game and collecting a broad spectrum of wild plant foods. A series of sleeping circles or camp clearings, trails, shrines, rock alignments, and zoomorphic intaglios identified throughout southern Arizona are believed to date to the Archaic period (Hayden 1982; Rogers 1966).

The end of the Archaic period, most recently termed the Early Agricultural period, is generally seen as a time when sites showed the beginnings of settled village life, and pottery manufacture and farming activities were added to the cultural repertoire. However, this is not a strict dichotomy because brown plain ware ceramics do occur earlier. Additionally, Late Archaic groups in central and southern Arizona are known to have been experimenting with agriculture as one aspect of their subsistence strategy (Huckell 1995).

3.4.3.3 PREHISTORIC CERAMIC PERIOD

The prehistoric Ceramic period in southern Arizona generally refers to two chronologically contemporaneous Ceramic period traditions dating between A.D. 300 and 1400—the Hohokam and the Patayan—which succeed the Archaic in southwestern Arizona.

3.4.3.3.1 Hohokam

Although the Hohokam lived throughout central and southern Arizona, the following discussion is limited to a consideration of the Gila-Salt Basin and the Gila Bend area because these areas encompass both the Project Area and the areas of greatest influence on peoples in the Project Area. Hohokam villages along the Gila River extended as far west as the Gila Bend area; some of the villages along the Gila River were quite large and had public architectural features such as ball courts and platform mounds.

In the Gila-Salt Basin, the Pioneer period (A.D. 300–775) saw the appearance of canal irrigation along the Salt River (Ackerly and Henderson 1989; Dean 1991). Irrigation systems were expanded and became well established during the Pioneer period; people lived primarily in square or rectangular pit houses.

During the Colonial period (A.D. 775–975), domestic architectural units began being arranged into clusters or courtyard groups (Howard 1985; Wilcox et al. 1981). Monumental architecture, in the form of ball courts, is seen at some, but not all, Colonial period villages in the Gila-Salt Basin and the Gila Bend area, where it is believed permanent villages had been established by this time.

The Sedentary period (A.D. 975–1150)—is characterized by further expansion of settlements and canal irrigation systems as well as the development of various alternate agricultural strategies. The construction of ball courts continued, and another form of monumental architecture, the platform mound, took shape.

The Classic period (A.D. 1150–1450) exhibited radical shifts in material culture, architecture, mortuary practices, and settlement patterning. Agricultural intensification occurred in the Gila-Salt Basin, platform mounds become more prevalent, "big houses" were constructed, and ball court construction declined. A change in relations with the Gila-Salt Basin is evident in the Gila Bend area, where architectural styles no longer mirror those observed in the core area, pit houses continue being constructed (in contrast to the aboveground structures that come into favor in the core), and irrigation canals are abandoned.

A Late Classic or post-Classic occupation, labeled the Polverón phase, has been identified at a small number of sites in the Gila-Salt Basin (Crown and Sires 1984; Sires 1983). Researchers are still debating how to interpret this phase (i.e., Chenault 1995; Craig 1995; Hackbarth 1995), which is characterized as having clustered houses, some of which were constructed on top of previously abandoned platform mounds and high quantities of obsidian. Salado Polychromes were the dominant ceramic ware at this time.

3.4.3.3.2 Patayan

Other farming societies along the Lower Colorado River Valley are identified as belonging to the Patayan culture (McGuire and Schiffer 1982). Unlike the Hohokam, the Patayan cultural tradition is poorly understood because it has not been the focus of many research projects, and excavations of Patayan sites have tended to go unreported in detail (McGuire 1982a; Stone 1986, 1991). Nonetheless, the Patayan appear to have practiced floodwater farming rather than build canal systems like the Hohokam. The three phases in the sequence have been assigned ranges of time based on the presence of certain Hohokam ceramic types that are found in association with various Patayan types. Patayan I is generally believed to date from A.D. 700 to 1000. Patayan II extends to about A.D. 1500, and Patayan III continues into the 1800s or even 1900s (Roberts et al. 1996).

Much of the southwestern Arizona Patayan sites appear to be ephemeral, indicating the remains of camps or limited-activity locations; however, larger sites, particularly along the Gila River, represent more permanent villages (McGuire and Schiffer 1982). In addition, fairly substantial Patayan sites that represent repeated visitation over long periods have been reported from the interior desert, south of Gila Bend (Bruder and Hill 2000; Huckell 1979). The Patayan tradition is characterized by plain and decorated ceramics (Rogers 1945; Waters 1982), and subsistence activities are believed to have been focused on floodwater farming along the Colorado River and lower Gila River.

3.4.3.4 ETHNOHISTORIC PERIOD

When Europeans first arrived in the area, they encountered a diversity of Native American groups in what is now southwestern Arizona (McGuire 1982b; Stone 1986, 1991; Whittlesey et al. 1994). Piman speakers (members of the Pima, Tohono O'odham, Sobaípuri, Hia C-ed O'odham, and Kohatk ethnic groups) generally used the east half of the region, whereas Hokan (Quechan, Mohave, Cocopah, Maricopa, and Yavapai) and Shoshonean (Chemehuevi) speakers lived to the west, especially along the lower Colorado River.

3.4.3.4.1 Yavapai

The Yuman-speaking Yavapai inhabited west-central Arizona north of the Salt and Gila rivers. Following a seasonal round, the Yavapai moved from lowland desert to upland chaparral and woodlands to hunt, collect wild plant resources, and tend their fields. They were organized into local groups or camps of up to 10 related households.

Conflicts between the Yavapai and Euro-Americans started with the discovery of gold in the Prescott highlands in the 1860s. Although some Yavapai were convinced to move to the Colorado River Indian Reservation, hostilities between the two groups continued into the late 1860s. By 1871, about 1,000 Yavapai were confined to the military installation at Camp Date Creek (Boles 1994), and by 1873, the Yavapai were defeated militarily, with an estimated loss of 15% to 30% of the tribal population. The survivors were incarcerated at Camp Verde, and in 1874, they were marched to the San Carlos Reservation, where they lived with the Apache for about 25 years.

By 1900, many Yavapai had returned to their homeland along the Verde River, and only about 200 remained at San Carlos. In addition to the Fort McDowell Reservation, established on the lower Verde River in 1903, the Yavapai were given a small, 40-acre parcel near Camp Verde in 1910; they were given subsequent acreage in 1914, 1916, and in the 1950s, for a total of 635 acres. A small 75-acre reservation was created near Prescott in 1935 and enlarged by 1,320 acres in 1956.

3.4.3.4.2 Maricopa

A linguistically related group was the Maricopa, who lived along the lower Gila and Colorado river valleys to the south and west of the Project Area and used the adjacent uplands (Stein 1981). According to limited and inconsistent Spanish accounts, approximately 10 Yuman-speaking groups were identified as living along the lower Colorado and lower Gila rivers and were organized into a series of alliances. Groups residing along the lower Gila River are referred to as the Panya (Bean and Vane 1978).

In the 1700s, the population of the Panya was probably around 5,000, formed from people who lived along the lower Colorado River in dispersed settlements, or *rancherias*, comparable to other Yuman-speaking groups. Their subsistence consisted of hunting game, collecting wild plant foods, fishing, and farming using floodwater techniques. Around 1839, under increased pressure from other indigenous groups, the Panya groups were driven from the lower Colorado and lower Gila river valleys and took up residence in south-central Arizona adjacent to the Pima, who were village-dwelling farmers living above the confluence of the Gila and Salt rivers. This group became known collectively as the Maricopa. They adopted aspects of Hispanic culture, including cattle, horses, mules, wheat, and possibly barley. Some Maricopa served as Spanish interpreters for the Akimel O'odham (Harwell and Kelly 1983).

Today, the Maricopa continue to reside primarily in two communities. A total of 5,400 tribal members lives in the Salt River Pima-Maricopa Indian Community, of which approximately 100 are Maricopa and are concentrated in the Lehi area. Another 600 Maricopa are concentrated in the northwest part of the Gila River Indian Community near Laveen, Arizona.

3.4.3.4.3 O'odham

Desert-dwelling O'odham groups, such as the Tohono O'odham, Akimel O'odham, and the Hia C-ed O'odham, ranged primarily south of the Gila River. The material culture, social organization, and subsistence practices of the O'odham have been relatively well studied, compared with many of the other groups of Native Americans in southern Arizona (Bahr 1983; Castetter and Bell 1942; Fontana 1974, 1983).

The group closest to the Project Area is the Akimel O'odham, formerly known as the Pima. In 1859, the federal government established the first reservation in Arizona for the Akimel O'odham and Maricopa. In 1871, their land was left dry because upstream river flows were diverted via irrigation canals built by farmers settling on the Gila River in the Florence and Safford areas. Some Akimel O'odham and Maricopa moved north to the Salt River, where another reservation was established in 1879, whereas others moved to the confluence of the Salt and Gila rivers (DeJong 1992).

Today, there are O'odham communities across much of southern Arizona. The Tohono O'odham reservation areas are west of Tucson and south of Gila Bend; Akimel O'odham reside primarily on their reservation along the Gila River between its confluence with the Salt River and Florence, Arizona. The small group of people who identify themselves as Hia C-ed O'odham are not federally recognized as a tribe and live primarily in the Ajo, Arizona, area south of the Project Area.

3.4.3.5 HISTORIC PERIOD

The Spanish visited the Gila Bend area in 1699 and claimed authority over the region until 1821, when Mexico won its independence. Prospectors reportedly discovered hematite and other minerals in the local area as early as 1750 (Whittlesey et al. 1994). The more than three decades of Mexican dominion saw virtually no changes. However, in the mid-1800s, a few English- and French-speaking fur trappers made contact with the Piman-speaking groups living along the nearby Gila River. The pace of Euro-American settlement increased markedly once the United States acquired the region through war with Mexico and the subsequent Gadsden Purchase of 1854.

In 1846, during the war with Mexico, American troops of the Mormon Battalion built the Southern Overland Trail (also known as the Gila Trail), a wagon road that followed the Gila River through southwestern Arizona to Yuma. In 1865, settlers started a small community around a stage coach station at Gila Bend, and Daniel Noonan was named its first postmaster. In 1880, a railroad station was built nearby but further from the Gila River. The community of Gila Bend was moved to this new town site to be closer to the railroad (still in this location today), with Daniel Noonan as its first settler (Granger 1983).

In 1877, the founder of the settlement that was to become the Town of Buckeye led a party of six men, three women, and 10 children from Creston, Iowa, bound for Arizona. The leader of this party was Thomas Newt Clanton, whose purpose for coming west was to foster good health. Development in the region was spurred by construction of the Buckeye Canal from 1884 to 1886. In 1887, Clanton and his family moved to the Buckeye area, becoming the first permanent Euro-American residents, and in 1888, the Buckeye town site was laid out on a portion of the Clanton Homestead (Town of Buckeye 2009).

During the twentieth century, agriculture and ranching activities were the primary land uses in the area. Although riverine locations were favored for agriculture, some homesteading occurred in drier areas such as Rainbow Valley during the 1920s and 1930s, after General Land Office (GLO) surveys had occurred. During the 1930s, Works Progress Administration projects for water conservation were constructed in the area to support ranching. During World War II, in conjunction with the construction of what are now called Luke Air Force Base and the Barry M. Goldwater Range, several auxiliary fields were constructed to the north and south of the analysis area. These auxiliary fields were used for training pilots during World War II and into the Cold War.

3.4.4 Known Cultural Resources

3.4.4.1 CULTURAL RESOURCES IN THE PROJECT AREA

Nine archaeological sites were identified in the 8,646-acre analysis area (Swanson 2009). The BLM consulted with the Arizona SHPO to determine the NRHP eligibility of these nine sites. According to the NRHP, historic properties can be archaeological sites, objects, districts, buildings, or structures eligible for the NRHP.

To be eligible for the NRHP, sites must exemplify an important facet of history and maintain integrity of their significant features. The four criteria by which a site's significance is evaluated are as follows: a) association with an important event as part of broad patterns of history, b) association with an important person significant to history; c) representation of a particular style, design, or mode of construction, or the work of a master, or possession artistic value, and d) ability to provide important information about the past (National Park Service 1997).

Sites that fulfill one or more of these criteria and maintain integrity are considered eligible for the NRHP. SHPO concurred with the BLM's determination that three sites in the APE are eligible for the NRHP under Criterion D of 36 CFR § 60.4 for information potential (see Section 5.4 for detail on the SHPO and tribal consultation processes). These three sites—AZ T:10:238 (ASM), T:14:165 (ASM), and T:14:167 (ASM)—are prehistoric artifact scatters associated with the Hohokam Tradition. A description of all nine archaeological sites in the analysis area is provided in the following sections.

3.4.4.1.1 AZ T:10:238_(ASM)

AZ T:10:238_(ASM) is an artifact scatter of lithic and ceramic artifacts on the alluvial flats of Rainbow Valley. The ceramics suggest the site was used during the Classic and possibly pre-Classic periods. Because there are no surface features and a low density of artifacts, the site was likely only used briefly over time. This site is eligible for the NRHP.

3.4.4.1.2 AZ T:14:31_(ASM)

AZ T:13:31_(ASM) consists of a large area of plowed furrows. BLM records indicate that the furrowing was done in 1968 as part of a range improvement project. No other features or artifacts were observed. This site is ineligible for the NRHP.

3.4.4.1.3 AZ T:14:162_(ASM)

AZ T:14:162_(ASM) is a prehistoric linear artifact scatter on an alluvial flat. Artifacts consist of ceramic sherds and a basalt core tool and suggest the site dates to the Preclassic. The site has been heavily disturbed; Riggs Road, several washes, and several small two-track roads cross the site. The site appears to lack depth; no artifacts or features were noted in the road cuts or washes. This site is ineligible for the NRHP.

3.4.4.1.4 AZ T:14:163_(ASM)

AZ T:14:163(ASM) consists of a historic trash scatter dating to the late 1950s. The site is located at the end of an informal two-track road and probably represents a dumping episode. Artifacts include metal food cans, bottles, a part of a cook stove, and parts of kerosene lanterns. The bottles include cosmetic bottles, mayonnaise jars, and a Barq's root beer bottle. This site is ineligible for the NRHP.

3.4.4.1.5 AZ T:14:164_(ASM)

AZ T:14:164_(ASM) consists of a historic earthen water reservoir or tank and diversion dam, two corrals, and a small rip-rap dam in a wash. The tank has a well-defined spillway and a long berm for diverting water. The two corrals are constructed of modern fencing materials. Documents at the LSFO indicate that the water tank was constructed on the Beloat grazing allotment in 1939 with labor provided by the Civilian Conservation Corps (CCC). This site is ineligible for the NRHP.

3.4.4.1.6 AZ T:14:165 (ASM)

AZ T:14:165_(ASM) consists of two prehistoric rock piles and an artifact scatter near a large wash in Rainbow Valley. The rock piles are small and consist of local cobbles. Most of the artifacts are ceramic sherds, but lithic flakes and cores, ground_stone, and a hammer stone are also present. The ceramics observed reflect use during the pre-Classic and Classic periods. The site may have functioned as an intermittently occupied temporary or permanent habitation location over a long period. This site is eligible for the NRHP.

3.4.4.1.7 AZ T:14:166_(ASM)

AZ T:14:166_(ASM) is a prehistoric artifact scatter on the alluvial flats of Rainbow Valley. The artifacts consist of ceramic sherds and two lithic flakes and date to the Preclassic and/or Classic period. The site has been minimally disturbed by small washes and animals. Artifacts were only observed on the desert pavement; no artifacts were observed in the small drainages. This site is ineligible for the NRHP.

3.4.4.1.8 AZ T:14:167_(ASM)

AZ T:14:167_(ASM) consists of a partially buried, possible roasting pit, a cluster of local cobbles, and an artifact scatter near a small wash in Rainbow Valley. Artifacts found at the site consist primarily of ceramic sherds and one worked piece of marine shell (Laevicardium sp.) that likely originates from the Gulf of Mexico or southern California. The ceramics observed indicate use during the Late Pioneer–Early Colonial period and during the subsequent Classic period. The site may have functioned as a temporary habitation site. This site is eligible for the NRHP.

3.4.4.1.9 AZ T:15:96_(ASM)

AZ T:15:96_(ASM) is a low-density artifact scatter with three artifact concentrations. Artifacts consist mainly of ceramic sherds that date to the Preclassic and/or Classic periods. Several small washes and informal two-track roads cross the site; artifacts were not present in areas disturbed by the washes and roads. This site is ineligible for the NRHP.

3.4.5 Native American Consultation

Section 101(d)(6)(B) of the NHPA requires consultation with Indian tribes that attach religious and cultural significance to historic properties, including archaeological sites. This consultation is ultimately the responsibility of the federal agency overseeing the undertaking. There is a legal distinction between Indian tribes who are federally recognized and those who are not. Federal recognition signifies that the United States government acknowledges the political sovereignty and Indian identity of a tribe, and from that recognition flows the obligation to conduct dealings with that tribe's leadership on a "government-to-government" basis (ACHP 2009:3). The BLM must make a reasonable and good faith effort to identify such Indian tribes and invite them to be consulting parties. If such Indian tribes have not been invited by the agency to consult, the tribes may request in writing to be consulting parties and must be considered as such by the agency (ACHP 2009:7–8). See Section 5.4 (Government-to-government Consultation) for detail on the tribal consultation process.

The Section 106 regulations state that the agency official shall acknowledge that Indian tribes possess special expertise in assessing the NRHP eligibility of historic properties, including archaeological sites, that may possess religious and cultural significance to them (36 CFR § 800.4(c)(1)). Thus, the agency should consult with Indian tribes to carry out identification efforts and to evaluate the NRHP eligibility of identified properties for proposed undertakings located off tribal lands. The agency should provide Indian tribes with the same information that is provided to the SHPO during consultation, including information on buildings and other standing structures that may be affected by the proposed undertaking. A federal agency should not assume to know what is of significance to a particular tribe unless it has been advised by that tribe (ACHP 2009:18).

Tribal consultation for the SSEP is being conducted by the BLM. Several tribes have been consulted to obtain specific tribal concerns and information about the locations of areas of particular importance to tribes. The following tribes have been consulted:

- Tohono O'odham Nation
- Ak-Chin Indian Community
- Gila River Indian Community
- Hopi Tribe
- Yavapai Prescott Indian Tribe
- Salt River Pima-Maricopa Indian Community
- Fort McDowell Yavapai Nation
- Pascua Yaqui Tribe

These tribes have not identified any specific locations of traditional cultural importance or sacred sites in the Project Area.

3.5 Geology and Minerals

3.5.1 Overview

The analysis area for geological and minerals resources consists of the Project Area and areas of subsidence outside of the Project Area that may be affected by groundwater withdrawals (Map 10). In the analysis area, no unique or sensitive geological features or locatable or leasable minerals have been identified. Likewise, no geological hazards that could result in potential risks to project construction or operation have been identified.

3.5.2 Local Geology

The Project Area is located in the Little Rainbow Valley between the Buckeye Hills and Maricopa Mountains. It is located in the Margie's Peak 7.5-minute quadrangle map. Little Rainbow Valley is a small valley that lies between the Buckeye Hills to the north and the Maricopa Mountains to the south, and connects the much larger Rainbow Valley to the east with the Gila Bend area to the west (Map 11). The Project Area is situated on alluvial-fan deposits that are characteristic of Little Rainbow Valley.

The Buckeye Hills and Maricopa Mountains consist of igneous and metamorphic rocks of Early Proterozoic age. The Project Area is situated primarily on undivided Quaternary alluvium (Q) (Cordiviola 1980; Arizona Geological Survey [AGS] 2000).

Undivided Quaternary alluvium (Q) covers most of the land surface in the Project Area. Demsey (1989) described this unit as consisting of alluvial-fan deposits and being middle to latest Pleistocene in age (250,000 to 10,000 years old). Surficial deposits consist generally of gravel lags; whereas, subsurface deposits are characterized by well-sorted silt, sand, and gravel to cobbles. Approximately 3,699 acres of undivided Quaternary alluvium occur in the Project Area.

Younger Quaternary alluvium (Qy) is present in the extreme eastern part of the Project Area. This geological unit is exposed on broad terrace deposits and young alluvial fans that are inferred to be between 10,000 years old and the present (Demsey 1989). These deposits are typically fine-grained at the surface, but tend to be well-sorted sand and silt with local occurrences of gravel below the surface. Approximately 3 acres of younger Quaternary alluvium occur in the Project Area.

3.5.3 Geological Hazards

There are no recorded earthquakes or active faults in the Project Area, which is reflected in the low frequency or magnitude of earthquake activity (seismicity) of the area. Therefore, earthquakes, general seismicity, landslides, and active faulting are unlikely to occur in the Project Area (Kirby 2009a).

Drawdown of local groundwater in the greater Rainbow Valley for irrigation and other uses has resulted in ground subsidence, the relative downward motion of the local land surface (Schumann and Genauldi 1986; ADWR unpublished map). Schumann and Genauldi (1986) mapped 50 to 150 feet of water drawdown in the Project Area. Using interferometric synthetic aperture radar (InSAR), the ADWR has mapped four subsidence features in the Rainbow Valley Sub-basin (ADWR unpublished map). Two of these subsidence features are in proximity to the Project Area, east of the proposed power plant site (see Map 10).

Earth fissures are often a direct result of ground subsidence caused by groundwater drawdown in areas dominated by alluvium (Schumann and Genauldi 1986). As water is withdrawn from the alluvium, the

formerly water-supported pore spaces collapse, greatly reducing the volume of the alluvium and causing the land surface to sink and/or pull apart creating fissures. Earth fissures pose a danger to construction by completely destabilizing and destroying the land surface over time. Although there has been drawdown of groundwater through alluvium over time, Schumann and Genauldi (1986) mapped earth fissures throughout southern Arizona but did not report any fissures in or near the Project Area.

3.5.4 Mineral Resources

The potential for locatable and leasable mineral resources, such as metallic resources, petroleum, or geothermal deposits, is low to none in or near the Project Area (Kirby 2009a). Salable sand and gravel deposits are available in and outside of the Project Area. Those deposits outside of the Project Area are currently being quarried from a sand-and-gravel pit by Wesco Minerals, LLC. This operation extracts feldspathic white silica sand for use in various construction applications such as cement and playground sand.

3.6 Hazardous Materials and Hazardous and Solid Waste

3.6.1 Overview

The area of analysis for hazardous materials consists of the Project Area (see Section 3.1.1) where hazardous materials would be generated, as well as transportation routes to existing disposal sites in Maricopa County.

Certain chemicals and materials that would be used during the construction and operation of the SSEP are characterized as hazardous materials. In addition, construction and operation activities would generate certain hazardous and nonhazardous solid waste streams. This section discusses the following:

- Federal, state, and local laws, ordinances, regulations, and standards (LORS) that would govern the management of hazardous materials and hazardous and nonhazardous waste from the SSEP
- Existing conditions in the Project Area relevant to hazardous materials and hazardous and nonhazardous waste
- Locations for disposal of hazardous materials and hazardous and solid waste

3.6.2 Laws, Ordinances, Regulations, and Standards

3.6.2.1 LORS APPLICABLE TO WASTES GENERATED AT THE SSEP FACILITY

The LORS applicable to hazardous wastes and regulated, nonhazardous solid wastes that would be generated at the SSEP facility are summarized in Table 3.12. A more complete discussion for each of the summarized LORS can be found in *Hazardous Materials and Hazardous and Solid Wastes* (Parke 2009). Hazardous materials that may be used at the SSEP facility are discussed in Section 4.6 (Hazardous Materials and Hazardous and Solid Waste), and a hazardous material chemical inventory is provided in Table 4.45.

Table 3.12 LORS Applicable to Hazardous and Nonhazardous Wastes generated at the SSEP

LORS	Requirements/Applicability	Administering Agency
Federal		
Resource Conservation and Recovery Act (RCRA) 42 U.S.C. § 6901 et. seq. (1976) 40 CFR §§ 260, 261, 262 Hazardous Waste Management applicable to Generators Hazardous Waste Management, Arizona Revised Statues (A.R.S.) §§ 49-921 to 49-931	Requires hazardous waste generators to obtain an EPA Identification (EPA ID) number and annually register with the ADEQ to accumulate and store hazardous waste for no more than 90 days and ship hazardous waste under a manifest to a licensed disposal site. Requires generator to identify and profile hazardous waste, store hazardous waste in appropriate containers, label containers stored on-site and transported to disposal site, and train operators in hazardous waste management.	EPA Region IX, ADEQ
RCRA 42 U.S.C. § 6901 et. seq. (1976) 40 CFR § 263 Hazardous Waste Transportation, A.R.S. § 49-929	Requires hazardous waste generator to use registered transporters of hazardous waste that have an EPA ID number and to use manifests to accompany waste shipments and proper cleanup of any hazardous waste discharges.	EPA Region IX, ADEQ, ADOT

Table 3.12 LORS Applicable to Hazardous and Nonhazardous Wastes generated at the SSEP

LORS	Requirements/Applicability	Administering Agency
Universal Waste 60 *Federal Register* 25542, May 11, 1995, as amended at 64 *Federal Register* 36488, July 6, 1999; 70 *Federal Register* 45520, Aug. 5, 2005 40 CFR § 273	Requires management and employee training and proper disposal of universal waste that includes batteries, fluorescent lamps, mercury switches, and pesticides.	EPA Region IX, ADEQ
Used Oil Solid Waste Disposal Act, as amended (42 U.S.C. §§ 6905, 6912(a), 6921 through 6927, 6930, 6934, and 6974); and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§ 9601(37) and 9614(c)). 40 CFR § 279 A.R.S. §§ 49-801–818	Requires generators of used oil to prevent spills and correctly label, store, transport, and dispose/recycle used oil.	EPA Region IX, ADEQ
State		
AZPDES Program (33 U.S.C. § 1251, et seq., 49 A.R.S., Chapter 2, Article 3.1, 18 A.A.C. Chapter 9, Article 9 and 11).	Requires that the facility obtain coverage under the pending AZPDES Multisector General Permit, when issued. Under this permit, the facility would implement an approved SWPPP, and implement appropriate (BMP to, in part, avoid release of stormwater contaminated with hazardous materials or wastes.	ADEQ
Pollution Prevention A.R.S. §§ 49-961–969	Requires facilities that file a Superfund Amendments and Reauthorization Act (SARA) Section 313 Toxic Chemical Release Report to prepare and implement a pollution prevention plan that addresses a reduction in the use of toxic substances and the generation of hazardous wastes. Annual progress reports are also required.	ADEQ
Local		
Solid Waste Program A.R.S. §§ 36-136, 36-183.02, 36-601, 36-184.B4, 36-187.C, 11-251 paragraphs 17 and 31, 49-106, and 49-107, 18 A.A.C. Chapter 13 Maricopa County Health Code Chapters I and II	Requires the property owner to correctly handle, store, and dispose of all refuse accumulated on-site.	Maricopa County Environmental Services Department

3.6.2.2 LORS APPLICABLE TO HAZARDOUS MATERIALS USED AT THE SSEP FACILITY

The SSEP facility would use a number of designated hazardous materials during its construction and operation phases. A summary of the LORS applicable to hazardous materials that may be used at the SSEP facility are summarized in Table 3.13. A more complete discussion for each of the summarized LORS can be found in *Hazardous Materials and Hazardous and Solid Wastes* (Parke 2009).

Table 3.13 LORS Applicable to Hazardous Materials used at the SSEP

LORS	Requirements/Applicability	Administering Agency
Federal		
Emergency Planning & Community Right-to-Know Act (EPCRA), Section 302 (P. L. 99–499), 42 U.S.C. § 11022 Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370) A.R.S. §§ 26-341–353	Requires agency notification if extremely hazardous substances are stored in excess of Threshold Planning Quantities.	Arizona State Emergency Response Commission (AZSERC)Maricopa County Local Emergency Planning Committee (LEPC), and the Buckeye Fire Department
EPCRA, Section 311, (P. L. 99–499, 42 U.S.C. § 11021) Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370) A.R.S. §§ 26-341–26-353	Requires that either material safety data sheets (MSDS) for all hazardous materials or a list of all hazardous materials be submitted to AZSERC,LEPC, and local fire department.	AZSERC, Maricopa County LEPC, Buckeye Fire Department
EPCRA, Section 313, (P. L. 99–499, 42 U.S.C. § 11023) Toxic Chemical Release Reporting: Community Right-To-Know (40 CFR § 372) A.R.S. §§ 26-341–26-353	Requires annual reporting of releases of hazardous materials.	EPA Region IX, ADEQ, AZSERC Buckeye Fire Department
Hazardous Materials Transportation 49 CFR §§ 171–172	Requires transporters of hazardous materials to properly label, manifest, package, and ship hazardous materials.	ADEQ, ADOT and AZ Department of Public Safety
Chemical Facility Antiterrorism Standard, 6 CFR § 27	Requires facilities that possess any "chemicals of interest" above threshold quantities to register and provide specified information to the U.S. Department of Homeland Security.	Department of Homeland Security
Hazard Communication (HAZCOM) Program 29 CFR § 1910.1200 Safety and Health for Construction 29 CFR § 1926.1 et seq	Requires employers to implement HAZCOM standard that gives workers the right to know the hazards and identities of chemicals in their workplaces (29 CFR § 1910.1200). Requires written procedures and personnel protective equipment for employees working with hazardous materials.	OSHA
State		
Pollution Prevention A.R.S. §§ 49-961–969	Requires facilities that file a SARA Section 313 Toxic Chemical Release Report to prepare and implement a pollution prevention plan that addresses a reduction in the use of toxic substances and the generation of hazardous wastes. Annual progress reports are also required.	ADEQ
Local		
2006 International Fire Code	Requires the preparation of a hazardous material inventory statement and management plan.	Buckeye Fire Department

3.6.2.3 AGENCIES AND AGENCY CONTACTS

Federal, state, and local agencies responsible for administering the LORS that pertain to hazardous materials and hazardous and solid wastes are summarized in Table 3.14.

Table 3.14 Agencies and Agency Contacts

Agency	Contact/Phone/Email	Permit/Issues
EPA Region IX 75 Hawthorne Street Scan Francisco, CA 94105	Toll-free: (800) 300-2193 Telephone: (415) 947-4400	Spill Notification
ADEQ 1111 West Washington Phoenix, AZ 85007	Toll-free: (800) 234-5677 Telephone: (602) 771-2330	Spill Notification, Stormwater, Aquifer Protection Permit, Hazardous Waste Generation, Transportation and Disposal
National Response Center	Toll-free: (800) 424-8802 Telephone: (202) 267-2675	Reportable Quantity Spill or Release
Department of Homeland Security	Telephone: (202) 282-8000	Chemical Anti-terrorism Reporting
Occupational Safety and Health Agency Region IX 90 7th Street, Suite 18100 San Francisco, CA 94103	Telephone: (415) 625-2547	HAZCOM, Worker Safety Handling Hazardous Waste and Materials
Arizona Division of Occupational Safety and Health 800 W. Washington Street, 2nd floor Phoenix, AZ 85007	Darin Perkins, Director Telephone: (602) 542-5795	
Maricopa County Local Emergency Planning Commission 5630 E. McDowell Road Phoenix, AZ 85008	Christina Herrera Executive Director Telephone: (602) 273-1411 cristinaherrera@mail.maricopa.gov	Hazardous Material Usage, Reportable Quantity Spill or Release, Tier II Reports
AZSERC 5636 E. McDowell Phoenix, AZ 85008	Mark Howard, Director Toll-free: (800) 411-2336 Telephone: (602) 464-6346 azserc@azdema.gov	Hazardous Material Usage, Reportable Quantity Spill or Release
ADOT		Transportation of Hazardous Material and Waste
Maricopa County Environmental Services Division 1001 N. Central Ave. Suite 300 Phoenix, AZ 85004	Telephone: (602) 506-6970	Solid Waste Disposal
Arizona Department of Public Safety	Duty Officer (602) 223-2212	Transportation Related Release
Buckeye Fire Department 530 East Monroe Avenue Buckeye, AZ 85236	911 Telephone: (623) 349-6700	Fire, Emergency Response, Hazardous Material Usage, Spill or Release

3.6.3 Project Area Conditions

Primary land uses in and around the Project Area include agriculture, cattle grazing, mining, utilities, dispersed residential, recreation, and transportation. West of the Project Area, land uses include a regional landfill and state prison complex. Approximately 50 residences are located east of the Project Area in addition to two dairies surrounded by areas of agricultural lands. Industrial/commercial uses in the greater Project Area are minimal, consisting of two landfill facilities, a mineral products operation, and a prison facility.

The Project Area is almost entirely undeveloped, though a few areas have had isolated developments. There is no widespread prior use of the Project Area that would suggest that a concentration of hazardous waste is present. Isolated instances of refuse dumping, to the extent found in the Project Area, are household trash, rather than industrial wastes that would be more likely to contain hazardous materials.

The Southwest Regional Landfill is located southwest of the Project Area. This landfill is owned and operated by Allied Waste and includes disposals of municipal solid waste, construction/demolition debris, dead animals, asbestos, noninfectious medical waste, industrial and municipal sludges, petroleum contaminated soils, auto shredder fluff, special waste, and liquid waste.

3.6.4 Hazardous Waste Disposal Sites

Hazardous wastes generated during the construction and operation of the SSEP would be accumulated and contained on-site, in accordance with applicable LORS discussed in Section 3.6.2. The types of wastes that would be generated are disclosed in detail in Section 4.6 in Chapter 4. Under suitable manifest, such materials would be taken off-site by a licensed shipper to a permitted treatment, storage, and disposal facility. Qualified waste disposal sites in Maricopa County are listed in Table 3.15. Sufficient capacity is present at these facilities so that the additional waste materials generated by the SSEP would be accommodated (Parke 2009). The Butterfield Station Landfill is a very large facility that historically accepts much of the industry-generated nonhazardous wastes for the Phoenix metropolitan area. Clean Harbors Arizona operates a large hazardous waste treatment and disposal facility in west Phoenix that could accept most of the hazardous waste generated at the SSEP. Table 3.15 lists all other possibly waste treatment and disposal facilities that could accept the hazardous waste generated at the SSEP; no hazardous waste would be shipped out of state.

Transportation of wastes from the Project Area would use roadway routes that are suitable for hazardous waste transport (Map 12). SR-85 to the west of the Project Area would be the sole route for waste-hauling vehicles leaving the Project Area. These are established routes for commercial highway trucks. Wastes from the SSEP would not be transferred from haul trucks to railcars because the facilities in the region offer sufficient capacity for disposal.

Table 3.15 Waste Management Facilities in Maricopa County

Facility Name	Location	Services/Accepted Wastes	Unacceptable Wastes
Clean Harbors Arizona, LLC	1340 W. Lincoln Street Phoenix, AZ 85007	Full Service hazardous waste transfer and blending station Universal wastes Licensed RCRA treatment, storage and disposal facility	None generated at SSEP
City of Phoenix 7th Avenue Landfill and Transfer Station	3000 S. 7th Avenue Phoenix, AZ 85040	Construction waste, rock, dirt, green waste	Universal waste RCRA hazardous wastes
Butterfield Station	40404 S. 99th Avenue Mobile, AZ 85239	Construction debris, industrial and special wastes, nonhazardous sludges, and nonhazardous liquid wastes Universal waste	RCRA hazardous wastes Pb-acid batteries
White Tanks Transfer Station	18605 W. McDowell Road Buckeye, AZ 85326	Construction debris, industrial wastes, nonhazardous sludges, and wastes for recycle	RCRA hazardous wastes Pb-acid batteries
Belmont Waste Disposal	26403 W. US 85 Buckeye, AZ 85236	Construction debris, industrial wastes, and nonhazardous sludges	RCRA hazardous wastes Pb-acid batteries

3.7 Land Use and Access

3.7.1 Overview

The analysis area for land use and access consists of the Project Area (see Section 3.1.1) and also includes a 2-mile buffer surrounding the Project Area. This 2-mile buffer ensures that all access roads and ROWs that would be affected by the construction and operation of the SSEP are taken into consideration (Duncan 2009).

Current land uses in the analysis area are outlined in Table 3.16. The analysis area is primarily undeveloped land with small pockets of industrial use. It can be characterized as open desert with some agriculture and widely dispersed, low-density residential uses on private parcels.

Table 3.16 Analysis Area Land Uses

Land Use	Acreage
Low density residential	187.0
Industrial	402.0
Airport	6.0
Agriculture	3,384.0
Recreation	7,484.0
Public/quasi-public*	333.0
Vacant	68.0
Mining	2,994.0
Grazing	3,702.0
Land Use	**Mileage**
Utility corridors (power)	38.0
Utility corridors (digitized pipeline)	10.7

*Arizona State Prison Complex.

3.7.2 Laws, Ordinances, Regulations, and Standards

The primary legal basis for authorizing a ROW grant on BLM land is Section 501 of the Federal Land Policy and Management Act of 1976 (FLPMA). Under FLPMA, the Secretary of the Interior is authorized to grant, issue, or renew ROWs over, on, or through such land for utilities, roads, trails, highways, railroads, canals, etc. FLPMA provides the BLM with authority to issue ROW grants for the use, occupancy, and development of the public lands. The regulations establishing procedures for the processing of these grants are found in 43 CFR § 2800.

According to the Arizona statute, Title 14 Public Service Corporations; Corporations; Securities Regulation, Chapter 3 Corporation Commission Rules of Practice and Procedure, the Arizona Corporation Commission requires review of the general land-use plans (LUPs) within 2 miles of the Project Area. In its review of siting factors, the Power Plant and Transmission Line Siting Committee must consider potential impacts to the existing plans of the state, local government, and private entities for other developments.

Federal, state, and local land-use planning data were obtained from planning documents. The management prescriptions for these plans are outlined in Section 3.7.3 (Jurisdiction and Ownership). These plans consist of the following:

- *Final Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Lands in the 11 Western States* (DOE and DOI 2008). This programmatic EIS amends the *Lower Gila South Resource Management Plan (RMP)* to allocate lands to a west-wide system of energy transport corridors for the transmission of energy resources. Corridor 115-208 crosses the LSFO. This programmatic EIS designates the existing utility corridor adjacent to the SSEP as a component of the system of corridors. The energy produced by the SSEP would be transported via this corridor to the grid for consumers in Arizona.
- *Lower Gila South RMP,* as amended (BLM 2005a). This plan was developed to ensure that public lands are managed on a multiple-use and sustained-yield basis and that the quality of natural resources is preserved.
- ADOT. This department is responsible for planning, building, and operating the highway system throughout the state. No specific plan applies to the Project Area; however, specific proposed projects for the Project Area were reviewed.
- *Maricopa County Comprehensive Plan-2020 Eye to the Future* (Maricopa 2002). This plan was developed for controlled development with an effort to conserve resources and protect the environment while still providing an efficient transportation system. It is intended as a guide for decisions concerning growth and development and contains goals, policies, and standards to meet the plan.
- *Maricopa County SR-85 Corridor Area Plan* (2003). This plan was developed for the expansion of infrastructure and services, public recreation, water supply, protection of historic and cultural resources, and preservation of endangered and sensitive species and habitat for the immediate area around the SR-85 corridor and to be used in conjunction with the *Maricopa County Comprehensive Plan*.
- Maricopa Association of Governments. This regional agency is responsible for long-range transportation planning for the Phoenix metropolitan area. The *Interstate 10/Hassayampa Valley Transportation Framework Study* (2007a) and the *Interstate 8/Interstate-10 Hidden Valley Transportation Framework Study* (2009) developed potential transportation corridors throughout the Hassayampa Valley.
- *Town of Buckeye General Plan* (2007). This plan provides policy and decision-making guidelines related to development in the planning area. Designated land uses in the planning area would allow the town to manage growth effectively as it transitions from a small, rural farming community to a commerce center.
- *Town of Buckeye Parks, Trails, and Open Space Master Plan* (2005). This master plan provides principles to establish a comprehensive framework for sensitive areas, create linkages between existing and proposed recreation areas, ensure adequate quality and level of service for future parks, and promote community interaction. Near-term (1–5 years) and long-term (6–8 years) priorities were set and included a specific design evaluation of town trail and bicycle systems and development standards (see the *Town of Buckeye Trails Master Plan*).
- *Town of Buckeye Trails Master Plan* (2008). This master plan was developed to establish a network of trails to the recreational opportunities in the area. Conceptual trail alignments were developed to provide guidance as master-planned communities are built in order to ensure an integrated trail network.

- *City of Goodyear General Plan* (2003–2013). This general plan provides the foundation for the elements and implementation program that will guide growth and development decisions in the city's approximate 247-square mile planning area.

3.7.3 Jurisdiction and Ownership

Land jurisdiction refers to the limits of administrative authority maintained by a federal, state, or local governmental agency or organization. Jurisdiction does not necessarily imply land ownership; however, in some cases the authority that has jurisdiction may also own the land. Five categories of land jurisdiction or ownership, described below, are found in the analysis area (Table 3.17 and Map 11).

Table 3.17 Jurisdictions of Project Area and Analysis Area

Entity	Acres in Project Area	Acres in Analysis Area
BLM	3,702.0	30,470.0
Arizona State Land Department	5.2	5,585.0
Private	0.0	111,001.0
Maricopa (Unincorporated)	39.3	493.0
Town of Buckeye (Incorporated)	3,663.0	27,314.0
City of Goodyear (Incorporated)	0.0	5,928.0

Note: Acreages overlap and are not additive. For example, the acreage for the Town of Buckeye includes all acres of jurisdiction.

3.7.3.1 BUREAU OF LAND MANAGEMENT

Almost the entire Project Area (approximately 3,620 acres) and approximately 30,470 acres of the analysis area are located on public land administered by the BLM LSFO. The LSFO manages 1.4 million acres of public land in south-central Arizona for multiple use and provides opportunities for recreation, mining, wildlife habitat, grazing, and wilderness preservation in addition to other resource values and activities. The *Lower Gila South RMP* guides the management of the Project Area and the analysis area. The plan is designed to guide future management of public lands in the LSFO. A variety of land actions (e.g., ROWs, easements, and permits) is evaluated on a case-by-case basis. The RMP provides opportunities for multiple land uses in the Project Area, and the proposed renewable energy project conforms to the intent of the plan. A revision of the RMP is currently under development. A BLM team completed an LUP conformance analysis on November 21, 2008, and determined that the Proposed Action would not conflict with other decisions throughout the plan. No alternatives that would conflict with the plan have been considered.

The LSFO manages the Sonoran Desert National Monument (487,000 acres) and the North Maricopa Mountains Wilderness (63,200 acres), which are located 1 mile south of the Project Area. The monument is managed under the *Lower Gila South RMP* to protect archaeological, historical, and biological resources. A management plan for the Sonoran Desert National Monument is under development. According to the *Maricopa Complex Wilderness Management Plan* the objectives for managing the North Maricopa Mountains Wilderness are 1) to maintain or enhance the area's natural character; 2) provide a diversity of primitive recreational opportunities and a high degree of solitude; 3) maintain the present vegetation communities; and 4) provide habitat and water for a diversity of fauna (BLM 1995).

There are two 1-mile-wide, BLM-designated utility corridors that contain existing transmission and pipeline facilities north and south of the Project Area. Land-use demands for areas managed under the *Lower Gila South RMP* are mainly for road and utility ROWs. With increased population growth and development, additional uses in the designated utility corridors are expected. Although most of the Project Area is mapped as being in the incorporated Town of Buckeye, the BLM has exclusive jurisdiction over all land-use activities on BLM-managed land. The BLM would nevertheless work with the Town of Buckeye to ensure that the SSEP is constructed and operated in a manner that is consistent with relevant Town of Buckeye standards.

3.7.3.2 ARIZONA STATE LAND DEPARTMENT

Approximately 5,585 acres of dispersed sections of state land are located in the analysis area. Most of these sections are located in the western portion of the analysis area (generally in Township 2 South, Range 4 West) and are leased for grazing. The only project component that would be on state land in the Project Area is the westernmost portion of an access road that would be constructed within an existing transportation/utility corridor. A ROW would be needed from the Arizona State Land Department for that portion of the primary access road crossing state land.

3.7.3.3 UNINCORPORATED MARICOPA COUNTY

Maricopa County encompasses 5.9 million acres of land, consisting of land administered by the BLM, U.S. Forest Service, Arizona State Land Department, private property, and Indian Reservation land. Approximately 39 acres of unincorporated portions of Maricopa County are located in the Project Area and 493 acres in the analysis area. The only project component that would be on land in unincorporated Maricopa County is the easternmost portion of an existing access road.

The Maricopa County Comprehensive *Plan-2020 Eye to the Future* and the *Maricopa County SR-85 Corridor Area Plan* apply to the analysis area. The comprehensive plan designated portions of Maricopa County in the analysis area as rural development. Primary land uses include rural residential and agricultural uses. Designated future land uses within the SR-85 corridor planning area outline desired future development patterns with recognition of existing development activities and established patterns. Future land uses that occur in the analysis area include commercial and industrial development, rural density residential, and proposed open space.

3.7.3.4 TOWN OF BUCKEYE

Approximately 27,314 acres of the incorporated Town of Buckeye are in the analysis area and 3,663 acres are in the Project Area proper. However, the Town of Buckeye does not have jurisdiction on BLM land.

The *Town of Buckeye General Plan* includes the analysis area. Future land uses prescribed by the general plan for the analysis area include commercial and industrial development, low and medium-density residential development, and proposed open space.

3.7.3.5 CITY OF GOODYEAR

The SSEP would not be located in the incorporated City of Goodyear; however, approximately 5,928 acres of the analysis area are located in the incorporated City of Goodyear.

The *City of Goodyear General Plan* includes the eastern portion of the analysis area. Future land uses prescribed by the general plan include commercial and industrial development; and low, medium, and high-density residential development.

3.7.4 Existing Land Use

Land in the analysis area is largely undeveloped and is characterized by vacant open desert and by areas used for grazing, mining, utilities, and widely dispersed low-density residential development. Approximately 50 residences are located east of the Project Area in the analysis area, along with two dairies that are surrounded by agricultural land. Existing land uses are shown on Map 13.

The Southwest Regional Landfill and the Arizona State Prison Complex are located southwest of the Project Area in the analysis area. Both facilities are located adjacent to SR-85. Access to the landfill and prison is provided by SR-85.

Two grazing allotments overlay the Project Area. Please refer to Section 3.8 (Livestock Grazing) for more information on this land use.

OHV) use occurs throughout the analysis area, mostly on existing, unimproved roads and utility corridors. The Buckeye Hills Regional Park and Robbins Butte Wildlife Area are outside the analysis area; however, OHV users access the analysis area from Buckeye Hills Regional Park.

Existing ROWs on Arizona state land and BLM land are listed in Table 3.18 and Table 3.19, respectively. On Arizona state lands, ROWs consist of various transmission, distribution, and communication lines; rain gages, roads, easements; and the Jojoba Switchyard. On BLM land, ROWs consist of pipelines, transmission lines, and roads.

Table 3.18 Arizona State Land Department ROWs and Easements in the Analysis Area

Lease Number	Description	Location
18-105698	Transmission line and access road	Traverses the land-use analysis area west to east along the Komatke Road alignment to the Jojoba Switchyard
18-107441/ 18-109707	Distribution line	Traverses the land-use analysis area southwest to northeast west of the Project Area
18-103071	Communication line	Traverses the land-use analysis area north to south adjacent to SR-85 west of the Project Area
16-110986	Transmission line	Traverses the land-use analysis area east to west from SR-85 to the Jojoba Switchyard west of the Project Area
18-107648	Communication line	Traverses the land-use analysis area north to southwest of SR-85 and the Project Area
23-100009-18	Rain gages	West of the Project Area adjacent to Rainbow Wash
72-011068	Miscellaneous	Traverses the land-use analysis area north to south, west of SR-85 and the Project Area
72-032095	Miscellaneous	Section 23, Township 2 South, Range 4 West
14-105674	Transmission line	Traverses the land-use analysis area south from the Jojoba Switchyard west of the Project Area
14-106487/ 14-107947	Switchyard	West of the Project Area, north of the of the Komatke Road Alignment
18-106512	Road, distribution line, communication line	Traverses the land-use analysis area east from the Southwest Regional Landfill in the BLM-designated utility corridor and north into the Jojoba Switchyard west of the Project Area
72-004287	Gas line	Southwest of the Project Area within BLM-designated Corridor
72-006474	Miscellaneous	Southwest of the Project Area in Section 25, Township 2 South, Range 4 West
72-10350-1	Transmission line	Traverses the land-use analysis area west to east, north of the BLM-designated utility corridor and southwest of the Project Area
72-012160	Slurry pipeline	Traverses the land-use analysis area north to south adjacent to SR-85 west of the Project Area
16-110223	Road	Section 26, Township 2 South, Range 4 West
72-005377	Roadway	Section 23, Township 2 South, Range 4 West
72-007749/ 72-032095	Materials site	Section 23, Township 2 South, Range 4 West
14-088066	Gas transmission line	Section 25, Township 2 South, Range 4 West
14-111212	Gas line/roadway	Section 25,Township 2 South, Range 4 West
14-112025	Power line	Traverses the land-use analysis area south from the Jojoba Switchyard
72-006712	Power line	Section 25, Township 2 South, Range 4 West
72-086067	Gas transmission line	Section 25, Township 2 South, Range 4 West
16-110223	Roadway	Section 26, Township 2 South, Range 4 West
16-112078	Drainage channel	Section 26, Township 2 South, Range 4 West
56-112911	Road egress	Section 26, Township 2 South, Range 4 West

Source: Department of Mines and Mineral Resources (DMMR) (2007).

Table 3.19 ROWs and Other Use Authorizations in the Analysis Area

Serial Number	Description	Location
AZA 4287	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 8446	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 8756	Transmission line	Traverses the land-use analysis area south from Riggs Road and extends beyond the BLM-designated utility corridor
AZA 9002	Transmission line	Traverse north to south along the western portion of the land-use analysis area, and a portion of the Project Area, adjacent to SR-85
AZA 9977	Pipeline facility site	South of the Project Area within the BLM-designated utility corridor
AZA 10350	Transmission line	Traverses the land-use analysis area west to east and then runs northeast within the BLM-designated utility corridor north of the Project Area
AZA 13878	Pipeline facility site	South of the Project Area within the BLM-designated utility corridor
AZA 14739	Transmission line	Traverses the land-use analysis area west to east and then runs northeast within the BLM-designated utility corridor north of the Project Area
AZA 21968	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 29516	Roadway	Riggs Road alignment
AZA 31607	BLM national monument	Section 31, Township 2 South, Range 2 West; Sections 28–30 and 34–36, Township 2 South, Range 3 West; all Sections, Township 3 South, Range 3 West
AZA 32057	Transmission line-FLPMA	Sections 19–24, 29, and 30,Township 2 South, Range 2 West; Sections 29, 30–33, Township 2 South, Range 3 West; Sections 19–23, 26–30, 35, and 36, Township 2 South, Range 4 West
AZA 33063	Surface management plan (Wesco mining)	Sections 20, 29, and 30,Township 2 South, Range 3 West
AZA 33350	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 3335003	Roadway	Sections 27–30 and 34–36, Township 2 South, Range 2 West; Section 31, Township 2 South, Range 3 West
AZA 3335004	Temporary use permits construction access for Transwestern	Sections 27–30 and 34–36, Township 2 South, Range 2 West; Section 31, Township 2 South, Range 3 West
AZA 33585	Transmission line	Northwest of the Project Area within the BLM-designated utility corridor
AZAR 4861	Transmission line	Runs adjacent to Riggs Road west and then turns northwest through a portion of the Project Area, parallel to the Liberty to Gila Bend 230-kilovolt transmission line
AZAR 486101	Transmission line	South of the Project Area within the BLM-designated utility corridor
AZPHX 83253	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZPHX 86067	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 6263	Transmission line	East of the Project Area and north of Riggs Road
AZA 6728	Transmission line	East of the Project Area and north of Riggs Road
AZA 10028	Transmission line	East of the Project Area and north of Riggs Road
AZA 29997	Roadway	East of the Project Area and north of Riggs Road

Source: BLM (2009).

3.7.4.1 UTILITIES

Electric power lines and natural gas pipelines are located within two BLM-designated utility corridors adjacent to the Project Area. The Jojoba 500-kilovolt (kV) Switchyard, operated and maintained by SRP, is located on the Komatke Road alignment, on the western edge of the Project Area.

Existing power lines in the analysis area include the 1) Hassayampa to Kyrene 500-kV transmission line owned by SRP; 2) the Palo Verde to Pinal West 500-kV transmission line owned by SRP, Arizona Public Service (APS), Santa Cruz Water and Power Districts, and Tucson Electric Power; 3) the Jojoba to Gila River and Jojoba to Panda 500-kV transmission lines; 4) the Liberty to Gila Bend 230-kV transmission line; and 5) two 69-kV transmission lines owned by APS (Table 3.20).

Table 3.20 Existing Power Lines in the Analysis Area

Name	Voltage	Owner	Location
Hassayampa to Kyrene	500 kV	SRP	Traverses the analysis area west to east, connecting into the Jojoba Switchyard, and then runs northeast within a BLM-designated utility corridor
Palo Verde to Pinal West	500 kV	SRP, APS, Santa Cruz Water and Power Districts, and Tucson Electric Power	Traverses the analysis area west to east, connecting into the Jojoba Switchyard, and then runs southeast within a BLM-designated utility corridor
Jojoba to Gila River/Panda	500 kV	APS	Originates at the Jojoba Switchyard and traverses south in the western portion of the analysis areas, adjacent to SR-85
Liberty to Gila Bend	230 kV	APS	Traverse north to south along the western portion of the analysis area, and a portion of the Project Area, adjacent to SR-85
–	69 kV	APS	Runs adjacent to Riggs Road west and then turns northwest through a portion of the Project Area, parallel to the Liberty to Gila Bend 230-kV transmission line
–	69 kV	APS	Traverses the western portion of the analysis area and ties into the first 69-kV transmission line adjacent to the Liberty to Gila Bend 230-kV transmission line

Four El Paso natural gas pipelines and one Transwestern Pipeline are located in the BLM-designated utility corridor along the Komatke Road alignment in the southern portion of the analysis area (see Map 13). Three of the El Paso Natural Gas Pipelines are 30 inches in diameter, and the fourth pipeline is 26 inches in diameter. The Transwestern Pipeline is 36 inches in diameter.

The Hassayampa to Kyrene BLM-designated utility corridor is 1 mile wide (0.5 mile on either side of the existing 500-kV transmission line), and traverses the analysis area from the west to the east across the Jojoba Switchyard, and then runs northeast. The Palo Verde to Pinal West BLM-designated utility corridor is 1 mile wide, extending across the southern portion of the analysis area (see Map 13).

3.7.4.2 TRANSPORTATION AND ACCESS

SR-85 runs north and south for approximately 4 miles through the western portion of the analysis area and is called a major road for purposes of this analysis. SR-85 begins at the Mexico border and terminates at I-10 in Buckeye. The portion of SR-85 north of Gila Bend is part of the National Highway System. SR-85 is classified as a rural arterial highway in the Arizona State Highway System and a principal arterial highway on the National Highway System. There are no major roads in the Project Area.

There are 64 miles of primitive roads (including Rainbow Valley and Riggs road) in the eastern portion of the analysis area and 13.1 miles of primitive roads in the Project Area (Map 14). Although there are improved and unimproved roads following some section and half-section lines for access to dispersed agriculture and residential areas throughout the area of analysis, transportation corridors in the area are sparse. Komatke Road and Haul Road are primitive roads used to access the existing Jojoba Switchyard and the Wesco mining facility. Several primitive roads provide access from Komatke Road to the Sonoran Desert National Monument. Primitive roads are located along the BLM-designated utility corridors. The *BLM Approved Amendment Lower Gila North Management Framework Plan and the Lower Gila South RMP and Decision Record* designates the area of analysis as "limited" to OHVs. OHVs are limited to existing roads and vehicle routes. No cross-country vehicle travel is permitted (BLM 2005a). Several primitive roads totaling 13.1 miles cross the Project Area (see Map 14). Each of these routes is available for motorized travel. Refer to Section 3.11 for more information on OHV use. One private airstrip is located in the northeast portion of the analysis area.

3.7.4.3 RESOURCE EXTRACTION

The BLM database for mining claims on BLM-administered property indicates numerous current mineral claims in the northern and southwestern sections of the analysis area. In the Project Area, Wesco Minerals, LLC is quarrying sand and gravel deposits in Sections 12 and 21, Township 2 South, Range 3 West (see Map 13). The Wesco granite mine is located to the north and a processing plant is located to the west of the Project Area. Mine operations encompass 89 acres of land and include an open-pit mine, soil and overburden stockpiles, and a processing plant. The mine project also includes 5.6 miles of improved roads and 3.7 miles of dirt roads (BLM 2005b).

Past mining activities include the Buckeye Hills Mica Mine, which opened in 1949. Workings included a mill with a capacity for processing 6 tons per day of commercial-grade sericite (DMMR 2007). There are no current mining activities for this claim.

The surface and mineral estates on the Project Area are owned by the federal government and are administered by the BLM LSFO. The lands are open to mineral entry under the Mining Law and are open to mineral material sales under 43 CFR § 3602. There are no pre-1955 claims, oil and gas leases, or mineral activity occurring in the area. There is one mineral withdrawal in the area of analysis for the Sonoran Desert National Monument.

The current mineral claims are in conformance with the *Lower Gila South RMP*, approved June 1988. The RMP states:

> "Private industry is encouraged to explore and develop federal minerals to satisfy national and local needs. This policy provides for economically and environmentally sound exploration, extraction, and reclamation practices. Public lands are open and available for mineral exploration and development unless withdrawn or administratively restricted. Mineral development may occur along with other resource uses." (BLM 1985)

A review of the Arizona Department of Mines Land and Mineral Use records indicates that there are no current land claims besides the current transmission and pipeline corridors that are located generally north and south of the Project Area (DMMR 2007).

3.8 Livestock Grazing

3.8.1 Overview

The analysis area for grazing management consists of the project footprint where all vegetation would be removed to accommodate construction and operation of the SSEP. Two BLM grazing allotments intersect the Project Area. The Arnold grazing allotment intersects 1,053 acres of the western portion of the Project Area, and the Beloat grazing allotment intersects 2,649 acres in the eastern portion of the Project Area. The Arnold allotment is managed for ephemeral grazing by livestock, meaning that grazing occurs only when there is sufficient annual forage growth to support grazing. The number of animals authorized for ephemeral use varies greatly between years, depending on forage production, market conditions, and availability of steers. Neither of the grazing allotments in the Project Area is currently being grazed by cattle.

3.8.2 Laws, Ordinances, Regulations, and Standards

The Taylor Grazing Act of 1934, as amended was passed to protect public grazing land from overgrazing and soil deteriorating; "to provide for the orderly use, improvement, and development of public lands; and to stabilize the livestock industry dependent on the public range." (43 U.S.C. § 315–315r).

The Public Rangelands Improvement Act of 1978 (43 U.S.C. § 1901 et seq.) establishes and reaffirms the national policy and commitment to 1) inventory and identify current public rangeland conditions and trends; 2) manage, maintain and improve the condition of public rangelands so that they become as productive as feasible for all rangeland values in accordance with management objectives and the land-use planning process; 3) charge a fee for public grazing use that is equitable; and 4) continue the policy of protecting wild free-roaming horses and burros from capture, branding, harassment, or death, while at the same time facilitating the removal and disposal of excess wild free-roaming horses and burros that pose a threat to themselves, to their habitat, and to other rangeland values.

EO 12548 extends the Public Range Improvement Act of 1978. However, it includes a few minor changes to the Act. These changes specify, among other things, fees for grazing cattle on public lands.

43 CFR § 4100-Grazing Administration is the current guidance for administration of grazing on public lands exclusive of Alaska.

The Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management were developed to achieve the four fundamentals of rangeland health outlined in the grazing regulations (43 CFR § 4180.1). Those fundamentals are 1) properly functioning watersheds; 2) properly cycling water, nutrients, and energy; 3) state-met water quality standards; and 4) protection of habitat for special-status species.

3.8.3 Grazing Management

In the Beloat allotment, 2,988 AUMs of grazing use are currently authorized. In the Arnold allotment, there has been an average ephemeral use of 984 AUMs per year for the period from 1998 to 2007. An AUM refers to the amount of forage necessary to feed one animal unit for a period of one month. An animal unit is defined as one mature cow weighing approximately 1,000 pounds and one calf up to weaning age, usually six months, or their equivalent of other animals. Other than the allotment boundary fence, the CCC stock pond is the only range improvement within the Project Area. No evaluation to determine if the allotments are meeting rangeland standards has been completed. However, based on monitoring data there are no indications that the allotments are not meeting these standards.

3.9 Noise

3.9.1 Overview

This section presents an evaluation of existing sound levels associated with the SSEP (see Section 3.1.1 for Project Area description). The area of analysis for noise is approximately 14,750 acres, including the approximately 3,620-acre Project Area, and is largely vacant desert land managed by the BLM. The area of analysis for noise is the project footprint plus an area extending outward to include adjacent residential areas, the Buckeye Hills Regional Park, Sonoran Desert National Monument, and the North Maricopa Mountains Wilderness. Elevations in and adjacent to the Project Area range from approximately 1,050 to 1,120 feet amsl. Little Rainbow Valley is sparsely populated, with approximately one to two dozen widely separated residences up to 4 miles east of the Project Area. These are the closest known residential properties.

To adequately assess the noise related impacts of a proposed large industrial facility (such as the SSEP), an ambient noise monitoring program is necessary in order to document baseline conditions for later comparison with future noise levels. Such an assessment is typically performed at any nearby noise-sensitive areas (residences, schools, churches, libraries, etc.) that may be affected by project noise (Mantee 2009).

3.9.2 Laws, Ordinances, Regulations, and Standards

3.9.2.1 FEDERAL

3.9.2.1.1 EPA

In 1974 the EPA created guidelines to assist state and local government entities in the development of state and local LORS for noise (EPA 1974). Because local LORS have been adopted and are pertinent to the SSEP, these EPA guidelines are for informational purposes only.

3.9.2.1.2 Occupational Safety and Health Administration

On-site noise levels are regulated by the Occupational Safety and Health Act of 1970 (29 CFR § 1910.95). The noise exposure level of workers is limited to 90 dBA, over a time-weighted average (TWA) eight-hour work shift to protect hearing. If there are workers exposed to a $TWA_{8\text{-hour}}$ above 85 dBA (i.e., the OSHA Action Level), then the regulations call for a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention.

3.9.2.2 STATE

3.9.2.2.1 Arizona Division of Safety and Health

The Arizona Occupational Safety and Health Act of 1972 provides safety and health protection for employees in Arizona. The act requires each employer to furnish his or her employees with a place of employment free from recognized hazards that might cause serious injury or death. The Act further requires that employers and employees comply with all workplace safety and health standards, rules, and regulations promulgated by the Industrial Commission. The Arizona Division of Occupational Safety and Health, a division of the Industrial Commission of Arizona, administers and enforces the requirements of the act.

With respect to noise exposure to workers, the Arizona OSHA regulations closely mirror the federal OSHA regulations described above and, for practical implementation, are herein considered to be equivalent.

3.9.2.2.2 Arizona Vehicle Code

Noise limits for highway and OHVs are regulated under the Arizona Vehicle Code, established in A.R.S. §§ 28-955 and 28-1179. The limits are enforceable on the highways by any authorized law enforcement officer in the state (such as the Arizona Highway Patrol or by County Sheriff Departments).

Section 28-955: "A motor vehicle shall be equipped at all times with a muffler that is in good working order and that is in constant operation to prevent excessive or unusual noise. A person shall not use a muffler cutout, bypass or similar device on a motor vehicle on a highway."

Section 28-1179.3: "Except when operating on a closed course, either a muffler or other noise dissipative device that prevents sound above 96 decibels (dB). The director shall adopt the current sound measurement standard of the society of automotive engineers for all-terrain vehicles and motorcycles and the current sound measurement standard of the international organization for standardization for all other off-highway vehicles."

3.9.2.3 LOCAL

3.9.2.3.1 Maricopa County Ordinance

The Project Area is partially located in an unincorporated area in Maricopa County. The Maricopa County Planning and Development Department has established the following policy statement regarding noise:

At and above certain levels, noise is detrimental to the health and welfare of Maricopa County citizens. As stated in Maricopa County's policy statement regarding noise, "Maricopa County has determined that it is in the best interest of its citizens to control noise in a manner that promotes commerce; the use, value, and enjoyment of property; sleep and repose; and environmental quality. Therefore, it is hereby declared to be the policy of Maricopa County to prohibit excessive, unnecessary, disruptive, and annoying noises from all sources." (Maricopa 2006)

This policy statement is implemented via County Ordinance P-23, "Noise Ordinance." This ordinance, adopted on February 15, 2006, does not incorporate any quantitative noise level limits but rather prohibits "public disturbances," which are defined as "any noise which disturbs the peace or quiet of any neighborhood if such noise can be heard from in closed residential structures located within 500 feet of the boundary of the property from which such noise emanates." (Maricopa 2006)

With respect to the SSEP, there are two notable exemptions. P-23, Section VI, Paragraph 14, of the exemptions section states that "noise emanating from power plant equipment during normal operations" is exempt from the provisions of P-23 (Maricopa 2006). Paragraph 9 states that "noise emanating from construction and repair equipment when used in compliance with existing Maricopa County rules and regulations" is exempt (Maricopa 2006). No Maricopa County ordinances or regulations were found that deal with vibrations or vibration levels, either during construction or operations.

3.9.2.3.2 Town of Buckeye

The business center of the Town of Buckeye is mainly centered at the intersections of the I-10, SR-85, and SR-60 freeways, several miles north of the Project Area. The Town of Buckeye incorporated area is adjacent to the Project Area, and two of the analyzed noise-sensitive receptors are in this area.

Noise issues are included in the Town's General Plan document (as a subsection under the Environmental Planning Element). There is no separate Noise Element as part of the General Plan (which was adopted 1/18/08). There is no specific noise ordinance for the Town; thus, any noise-related concerns would fall under the general provisions regarding dealing with nuisances. Therefore, no quantitative noise limits are currently in place for areas within the town limits.

3.9.2.3.3 City of Goodyear

The incorporated city limits of Goodyear are within approximately 1 mile of the eastern boundary of the Project Area. Goodyear has a planning area that extends beyond the city limits, and this planning area contains one of the analyzed noise-sensitive receptors. There are no known noise-sensitive receptors to the east of the Project Area that are in the incorporated area of the City of Goodyear. As with Buckeye, observed residences are in planning areas only (not within city limits) and would be under Maricopa County jurisdiction for noise-related issues.

3.9.3 Fundamentals of Acoustics

Acoustics is the study of sound, and noise is defined as unwanted sound. To assess sound levels and noise impacts, several descriptors and metrics are used by the acoustical industry. Noise is usually defined as unwanted sound because it interferes with speech communication and hearing, or is otherwise annoying. Under certain conditions, noise may cause hearing loss, interfere with human activities, and in various ways affect people's health and well being.

Technically speaking, airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. These fluctuations create sound waves that our ears are sensitive to. The range of pressures that cause airborne vibrations (i.e., noise) is quite large and would be cumbersome to deal with on an absolute basis. Therefore, noise is measured on a logarithmic scale, expressed in dB, which is the accepted standard unit for measuring sound pressure amplitude using a more manageable range of numbers.[1]

When describing sound and its effect on a human population, A-weighted sound levels are typically used to account for or approximate the response of the human ear. The term A-weighted refers to a filtering of the noise signal in a manner that corresponds to the way the human ear perceives sound. The A-weighted noise level has been found to correlate well with people's judgments of the "noisiness" of different sounds and has been used for many years as a measure of community and industrial noise (Harris 1991). The A-weighted sound level is denoted dBA or dB(A).

Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response effects also depends on several other perceptibility factors, including the following:

- Ambient (background) sound level
- General nature of the existing conditions (e.g., quiet rural vs. busy urban)
- Difference between the magnitude of the sound event level and the ambient condition

[1] The commonly held threshold of audibility is 20 micropascals, whereas the threshold of pain is on the order of 200 million micropascals; a pressure ratio of 10 million to one. By converting these pressures to a logarithmic scale (in terms of sound pressure levels expressed by dB), the range becomes a more convenient 0 to 140 dB.

- Duration of the sound event
- Number of event occurrences and their repetitiveness
- Time-of-day that the event occurs

Because most people do not routinely work with dB or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level number means. To help relate noise level values to common experience, Table 3.21 provides examples of typical A-weighted sound pressure levels for various everyday indoor and outdoor noise sources.

Table 3.21 Typical Sound Levels Measured in the Environment and Industry

Example Noise Source or Noise Environment	A-weighted Sound Levels (dBA)	Subjective Impression
Shotgun (at shooter's ear) or on a carrier flight deck	140	Painfully loud
Civil defense siren (100 feet)	130	–
Jet takeoff (200 feet)	120	Threshold of pain
Loud rock music	110	–
Pile driver (50 feet)	100	Very loud
Ambulance siren (100 feet) or in a boiler room	90	–
Pneumatic drill (50 feet) or in a noisy restaurant	80	–
Busy traffic; hair dryer	70	Moderately loud
Normal conversation (5 feet) or in a data processing center	60	–
Light traffic (100 feet); rainfall or in a private business office	50	–
Bird calls (distant) or in an average living room or library	40	Quiet
Soft whisper (5 feet); rustling leaves or inside a quiet bedroom	30	–
In a recording studio	20	–
Normal breathing	10	Threshold of hearing

Source: Beranek (1998).

Loud noise can be annoying, and it can have negative health effects (EPA 1978). The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, learning
- Physiological effects such as startling or temporary and permanent hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, unprotected workers in some industrial work settings may experience noise effects in the last category.

Given the wide variation in individual thresholds of annoyance, habituation to noise, and situational reactions to noisy environments, there is no common standard for assessing the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it with the existing or ambient environment familiar to that person. From an objective, measurable viewpoint, there are several standardized noise-level metrics that are commonly used for qualitatively assessing a given noise

environment or acoustical situation. Common descriptors of environmental noise consist of the equivalent noise level (L_{eq}) and statistical sound levels (L_{90}, L_{50}, and L_{10}). Additional composite descriptors consist of the day-night level (L_{dn}) and community noise equivalent level (CNEL). These descriptors and other acoustical terms are further defined below (also see the glossary).

- Ambient noise level: The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level is often defined by the L_{eq} level (see below for more information on special noise metrics).
- Background noise level: The underlying, ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up the background noise level. The background level is generally defined by the L_{90} percentile noise level.
- Intrusive noise: Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient or background noise level, and the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.
- dB: A dB is a dimensionless unit of level which denotes the logarithmic (base 10) ratio between two quantities that are proportional to power; the denominator of this ratio is a reference standard which must be specified to give the dB level any meaning. dBs describe the loudness of sound and noise in terms of sound pressure levels and sound power levels.
- Sound pressure level: The level, expressed in terms of dBs, that is 20 times the logarithm of the given sound pressure over the reference pressure of 20 micropascals = 2×10^{-5} Newtons/m^2 = 0.0002 μbar = 2×10^{-4} dynes/cm^2. Sound Pressure Level, abbreviated SPL or Lp, is dependent on the distance from the source to the receiver.
- Sound power level: The level, also expressed in terms of dBs, that is 10 times the logarithm of the given sound power over the reference power of 1 picowatt. Sound Power Level, abbreviated PWL or Lw, is an inherent characteristic of the noise source and, therefore, is independent of distance from the source.
- dBA: The sound level in dBs as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. Thus, A-weighted sound pressure levels are the most common noise metric used to describe community noise and all sound levels in this report are A-weighted.
- Frequency: The number of times in 1 second that a periodic phenomenon repeats itself. The units of frequency are the hertz (Hz) which corresponds to one cycle per second.
- Band Pressure Level or Band Sound Level: This is the sound pressure level within a specified frequency band. The bandwidth is usually indicated by a descriptive modifier, such as octave band level or third-octave band level. As an example, the octave band level is the sound level within a frequency band corresponding to a specified octave. An octave is the frequency interval between two sounds whose basic frequency ratio is 2 (e.g., 500 Hz and 1,000 Hz are one octave apart). Note that octave band center frequencies and band limits are standardized by international agreement.
- Equivalent noise level (L_{eq}): The energy-equivalent noise level over a specified period of time (e.g., 1 hour). It is an equivalent single value of sound that includes the same acoustic energy as the actual, varying sound levels in a given period of time.

- Percentile noise level or Statistical sound levels (L_{90}, L_{50}, and L_{10}): The noise level exceeded during *n* percent of the measurement period, where *n* is a number between 0 and 100. The most common statistical sound levels used in community noise analyses are the L_{90}, $L_{50,}$ and L_{10} levels. The L_{90} is the sound level exceeded 90% of the time and is often considered the effective background or residual noise level. The L_{50} is the sound level exceeded 50% of the time and is known as the median noise level. The L_{10} is the sound level exceeded 10% of the time, is a measurement of intrusive sounds (such as aircraft flying overhead), and is commonly known as the effective maximum or intrusive sound level.
- Day-night level (L_{dn}): This metric was developed to account for an increased human sensitivity to nighttime noise levels and for the greater potential annoyance of noise during the nighttime hours. The actual nighttime noise levels are adjusted, based on the premise that both exterior and interior noise levels are generally lower than daytime levels and, therefore, nighttime noise can be more noticeable (than daytime conditions at the same location). Also, because most people sleep at night, there is often an increased sensitivity to intrusive noises. The day-night noise level, abbreviate L_{dn}, is the energy-average A-weighted sound level over a 24-hour period with an added 10 dB adjustment (penalty) for sounds that occur between 10 PM and 7 AM
- CNEL: The CNEL is similar to the L_{dn}, but differs in that a 5 dB evening penalty is also added to sounds that occur between 7 PM and 10 PM (as well as the L_{dn} penalty of +10 dB for nighttime sounds). In a large percentage of cases for general community noise, the L_{dn} and CNEL can be considered as equivalent.

3.9.4 Existing Noise Sources in the Area of Analysis

The Sonoran Desert National Monument and the North Maricopa Mountains Wilderness are located south of the Project Area and are composed of undeveloped desert areas with dirt roads for access. There are few daytime noise sources in proximity to the Project Area. SR-85 is nearly 8 miles away from areas with residential land uses. The nearest paved road is Rainbow Valley Road, a north-south, two-lane road that is 4.4 miles to the east of the eastern power block. All other roads in the vicinity of the Project Area, including Riggs Road, Pipeline Road, and all residential access roads, are dirt roads that are generally flat and well maintained.

All these dirt roads were observed to have sporadic traffic (typically less than one or two vph during the daytime). During the midday hours, high-altitude aircraft were observed, primarily military planes traveling to and from Luke Air Force Base. No sonic booms were noted during the survey period from these military aircraft. Other daytime noise sources included natural sounds from birds and insects.

The predominant noise sources during the daytime were general environmental din, rustling vegetation, birds, and occasionally insects, aircraft in the distance, and localized equipment (such as generators or air conditioners). Likewise, during the nighttime hours, the predominant noise sources included general environmental din, insects, aircraft in the distance, and distant barking dogs. There were no periods during which excess wind (i.e., wind velocities above industry standards for outdoor measurements[2]) were noted, so wind noise was not considered to be noteworthy during the field observation sessions.

For all time frames, the noise environment was observed to be extremely quiet. Details of the ambient noise survey are discussed in Section 3.9.5.

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[2] For example, the ANSI sets a guideline for wind speeds conducive for making outdoor sound level measurements at ≤ 6 m/sec (or 13.4 mph). This is found in ANSI S1.13, "Methods for the Measurement of Sound Pressure Levels," Section 3.4.2.4, Atmospheric Conditions.

3.9.5 Baseline/Ambient Noise Level

3.9.5.1 SURVEY METHODOLOGY

A baseline noise monitoring program was conducted August 9 through 11, 2009 (Mantee 2009). The ambient noise monitoring program consisted of continuous and simultaneous 25-hour noise measurements at three long-term (LT) monitoring locations (denoted LT-1, LT-2, and LT-3) and short-term (ST) monitoring at three additional locations (denoted ST-1, ST-2, and ST-3). Observations at all the monitoring locations were made at various times of the day and night to document local noise sources and overall environmental conditions. Short-term octave band sound-level measurements also were performed at the six monitoring locations.

During the field survey, local area meteorological conditions were noted and were recorded on a handheld weather instrument. Conditions during the survey can generally be described as hot and dry, with an absence of the monsoonal conditions that often predominate during this time of year. The air temperature (in °F) during the survey was in the mid to upper 80s overnight and in the low 100s during the days. Relative humidity generally ranged between 14% and 45% and barometric pressure was steady around 29.2 (± 0.2) inches of mercury. The skies were noted as generally being clear with some periods of partly cloudiness during both the night and day periods. Winds were noted as calm, or typically in the range of 1 to 3 mph with an occasional short period of breezes up to 6 to 8 mph. All these conditions were well within appropriate ranges for acceptable outdoor measurements per American National Standards Institute (ANSI) S1.13.

3.9.5.2 AMBIENT MEASUREMENT LOCATIONS

Six monitoring locations were chosen to quantify existing baseline noise levels within 7.4 miles of the Project Area (Map 15). There are no permanent, noise-sensitive receptors to the north, west, or south of the Project Area in the area of analysis. There are scattered permanent residential locations to the east of the Project Area, as well as two temporary-use wilderness/recreational areas to the south of the Project Area. One location is to the west, near an institutional (prison) facility.

The locations used for the 2009 ambient noise survey are summarized in Table 3.22. These measurement locations are the closest (from 0.9 to 7.4 miles away) and only noise receptors within several miles of the Project Area.

Table 3.22 Ambient Noise Measurements – Location and Timing

Type	Label	Name	Lat/Long	Monitoring (duration)	Distance to 250-MW (west) Block Centroid	Distance to 125-MW (east) Block Centroid
Long-term Monitors	LT-1	Hayes Rd. [Residential]	N 33° 13.796' W112° 30.470'	8/09/09, 16:58 to 8/11/09, 11:15 (42 hours, 16 min)	2.3 miles (12,295 feet)	1.3 miles (6,983 feet)
	LT-2	Baseline Rd. [Residential]	N 33° 13.508' W112° 28.258'	8/09/09, 19:25 to 8/11/09, 10:35 (39 hours, 10 min)	4.4 miles (23,496 feet)	3.3 miles (17,239 feet)
	LT-3	Sonoran Desert National Monument [Recreational]	N 33° 11.800' W112° 33.114'	8/10/09, 11:24 to 8/11/09, 12:39 (25 hours, 15 min)	3.3 miles (17,386 feet)	3.7 miles (19,598 feet)
Short-term Samples	ST-1	Prison frontage [Institutional]	N 33° 13.069' W112° 38.700'	Daytime: 8/10/09, 09:48 (15:00) Nighttime: 8/11/09, 01:31 (15:00)	6.2 miles (32,537 feet)	7.4 miles (39,061 feet)
	ST-2	Ocotillo Rd. [Residential]	N 33° 14.825' W112° 30.434'	Daytime: 8/10/09, 12:33 (15:00) Nighttime: 8/11/09, 04:02 (15:00)	2.2 miles (11,371 feet)	0.9 miles (4,658 feet)
	ST-3	North Maricopa Mountains Wilderness [Recreational]	N 33° 10.739' W112° 28.948'	Daytime: 8/11/09, 14:09 (15:00) Nighttime: none (see LT-3 data)	5.7 miles (30,269 feet)	5.1 miles (26,736 feet)

Notes: Daytime hours are between noon and 19:00; nighttime hours are between 22:00 and 07:00.

3.9.5.3 LONG-TERM MEASUREMENTS AND RESULTS

Long-term noise measurements (of at least 25 hours' duration) were conducted at three locations near the Project Area. The 24-hour metrics, CNEL and L_{dn}, were calculated from the sampled energy-average, L_{eq} values, starting at the sample period nearest the first whole hour. The results of these calculations are given in Table 3.23.

Table 3.23 Summary of Ambient 24-hour Noise-level Metrics

Location	Brief Description	24-hour L_{eq}, dBA	L_{dn}, dBA	CNEL, dBA
LT-1*	Hayes Road	47.6	49.7	49.8
LT-2*	Baseline Road	46.4	49.8	50.0
LT-3	Sonoran Desert National Monument	39.7	45.4	45.4

Source: Mantee (2009).

Note: 24-hour L_{eq}, L_{dn}, dBA, and CNEL are defined above in Section 3.9.3 (Fundamentals of Acoustics).

* 24-hour metrics were calculated from 7 AM to the following 7 AM for these locations.

The time-history records for the surveyed sound levels over the 25-hour monitoring period are shown in Figures 3.3–3.5 for LT-1, LT-2, and LT-3, respectively.

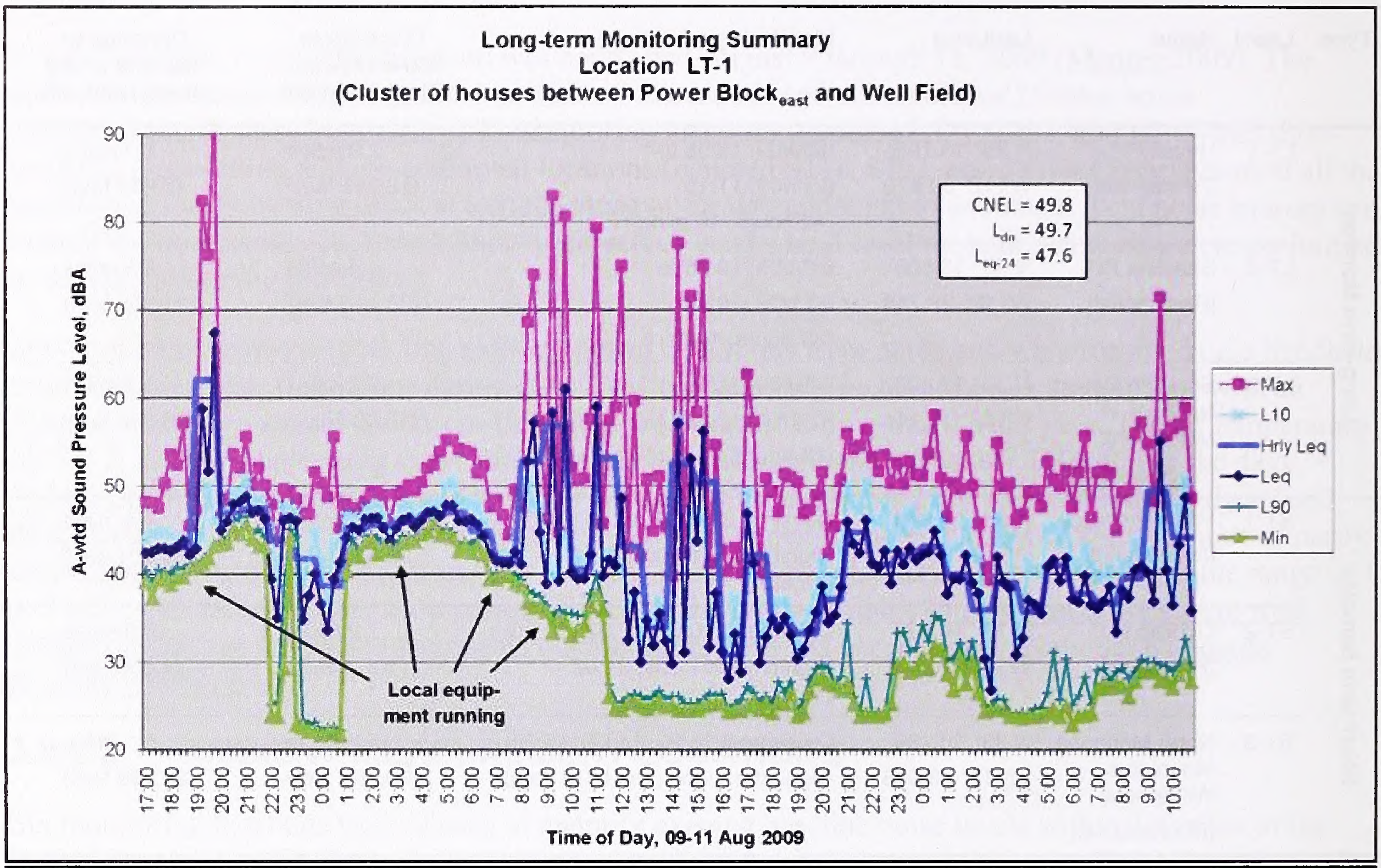

Figure 3.3 Ambient noise record for location LT-1.

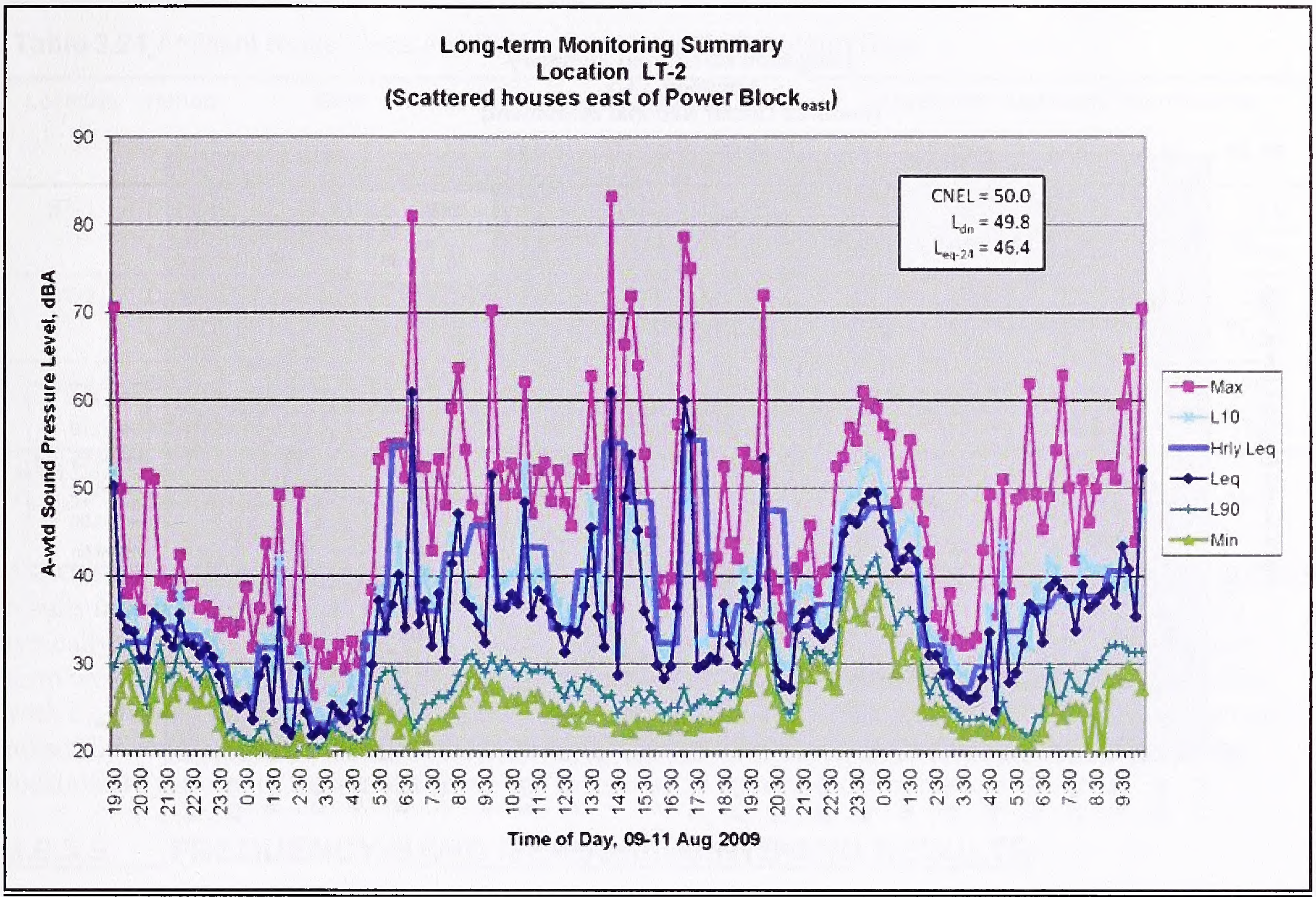

Figure 3.4 Ambient noise record for location LT-2.

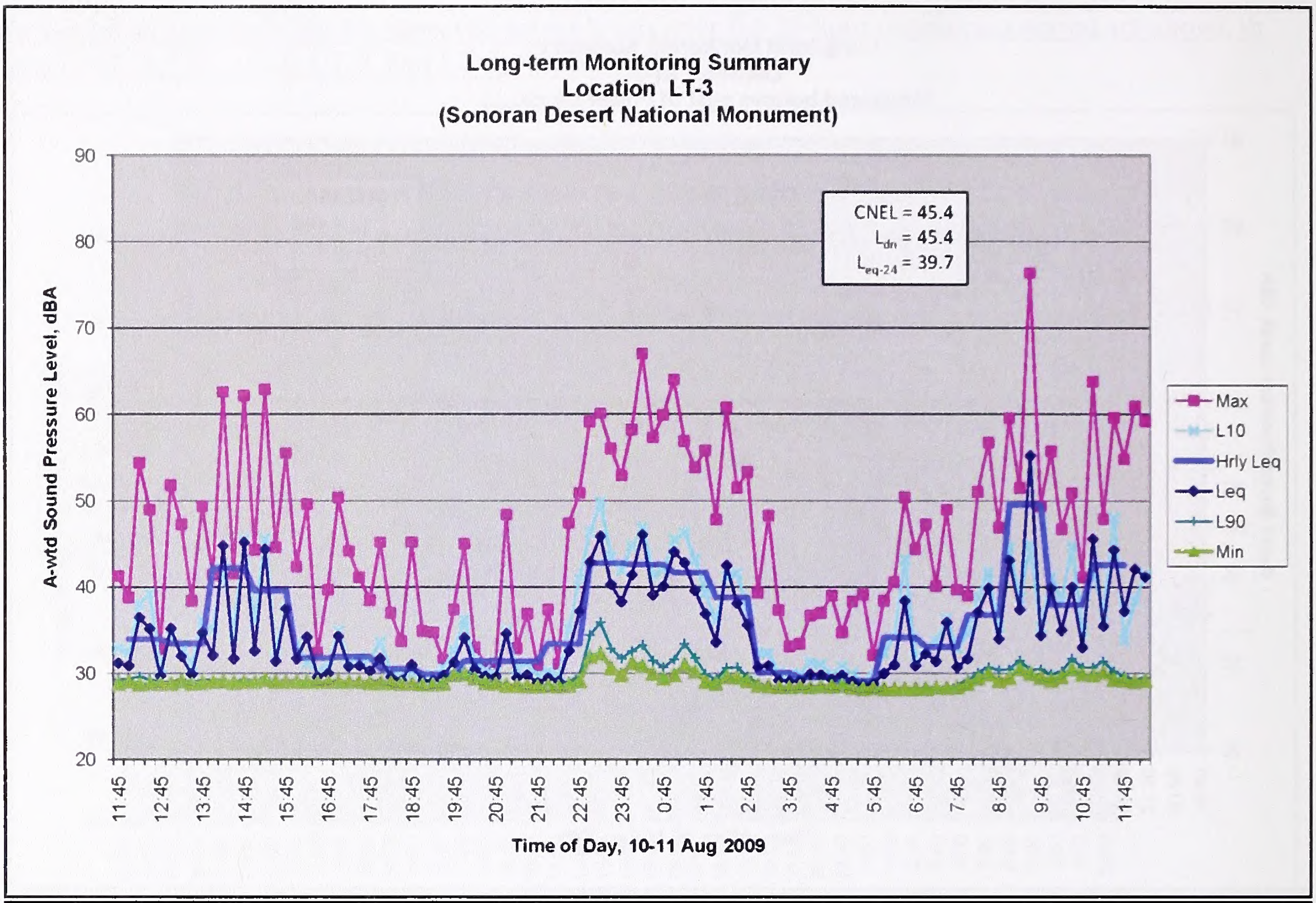

Figure 3.5 Ambient noise record for location LT-3.

Generally speaking, these long-term noise metrics indicate a very quiet environment, as would be expected for a sparsely populated, rural area with few noise sources. Besides the general low level din of these areas, other noise sources included aircraft flyovers (mostly military jets), sporadic dog barking and bird chirping, and localized events (such as running generators or air conditioning units). Very few cars or trucks were observed on Riggs Road, and even less local traffic was observed on the other access roads. The quietness of the overall environment is evidenced by the low levels (i.e., minimum sound pressure levels in the mid to low 20s dBA) during the late-night hours.

3.9.5.4 SHORT-TERM MEASUREMENTS AND RESULTS

To supplement the long-term monitoring, short-term noise readings were made at three locations around the Project Area. These short-term data acquisition sessions were each of 15 minutes' duration and were conducted at two different times of the day and night (nominally, daytime and nighttime) to gather additional information about the character and daily changes of the noise environment. Short-term sound levels are summarized in Table 3.24.

Table 3.24 Ambient Noise Measurements – Summary of Short-term Data

Location	Period	Date	Time	A-weighted Sound Level			A-weighted Statistical Sound Levels				
				Min(A)	L_{eq}(A)	Max(A)	L1	L10	L50	L90	L99
ST-1	Daytime	8/10/09	09:08	39.2	62.7	76.8	74.1	66.0	56.3	43.7	39.9
	Nighttime	8/11/09	01:31	39.5	56.3	73.4	70.3	57.9	44.3	41.2	39.8
ST-2	Daytime	8/10/09	12:33	24.4	33.8	45.9	43.1	37.4	30.2	26.3	24.4
	Nighttime	8/11/09	04:02	25.3	29.7	50.5	37.9	30.2	27.2	25.7	24.7
ST-3	Daytime	8/11/09	15:30	21.6	28.2	46.8	38.2	29.5	25.1	22.1	20.7
	Nighttime*			25.2	36.2	49.3	45.1	39.6	33.0	28.7	25.9

Notes: Daytime hours are between noon and 19:00; nighttime hours are between 22:00 and 07:00.
* Considered similar to location LT-3; data for ST-3 night are taken from a short-term measurement at LT-3.

As with the long-term data results, the lack of roadway, railway, industrial, or even farming sound sources results in a very quiet noise environment. Daytime L_{eq} levels in residential or recreational areas were typically in the upper 20s to mid 30s dBA (for locations away from SR-85 traffic). At night, the short-term measurements exemplified the extremely quiet characteristics of the residential/recreational areas, with L_{eq} values in the low 20s dBA. Other than barking dogs and insect activity, there were no observed noise sources at night. Even with the extremely quiet conditions, SR-85 traffic was not audible at the locations to the east of the Project Area, and there was no local vehicular traffic observed.

3.9.5.5 FREQUENCY-BAND MEASUREMENTS AND RESULTS

Third-octave band data measurements were also conducted at each of the six monitoring locations during selected periods of the daytime and nighttime. These data were very similar in their spectral shape and general lack of tonal components. The nontraffic spectra (i.e., other than location ST-1) have the same general downward trend with increasing frequency, which is typical for an outdoor ambient environment, because higher frequency noises are more readily absorbed in the atmosphere, as compared to low-frequency noises.

Examples of these representative spectra are given on Figure 3.6, which shows typical samples for the daytime, nighttime, desert, and traffic-related environments.

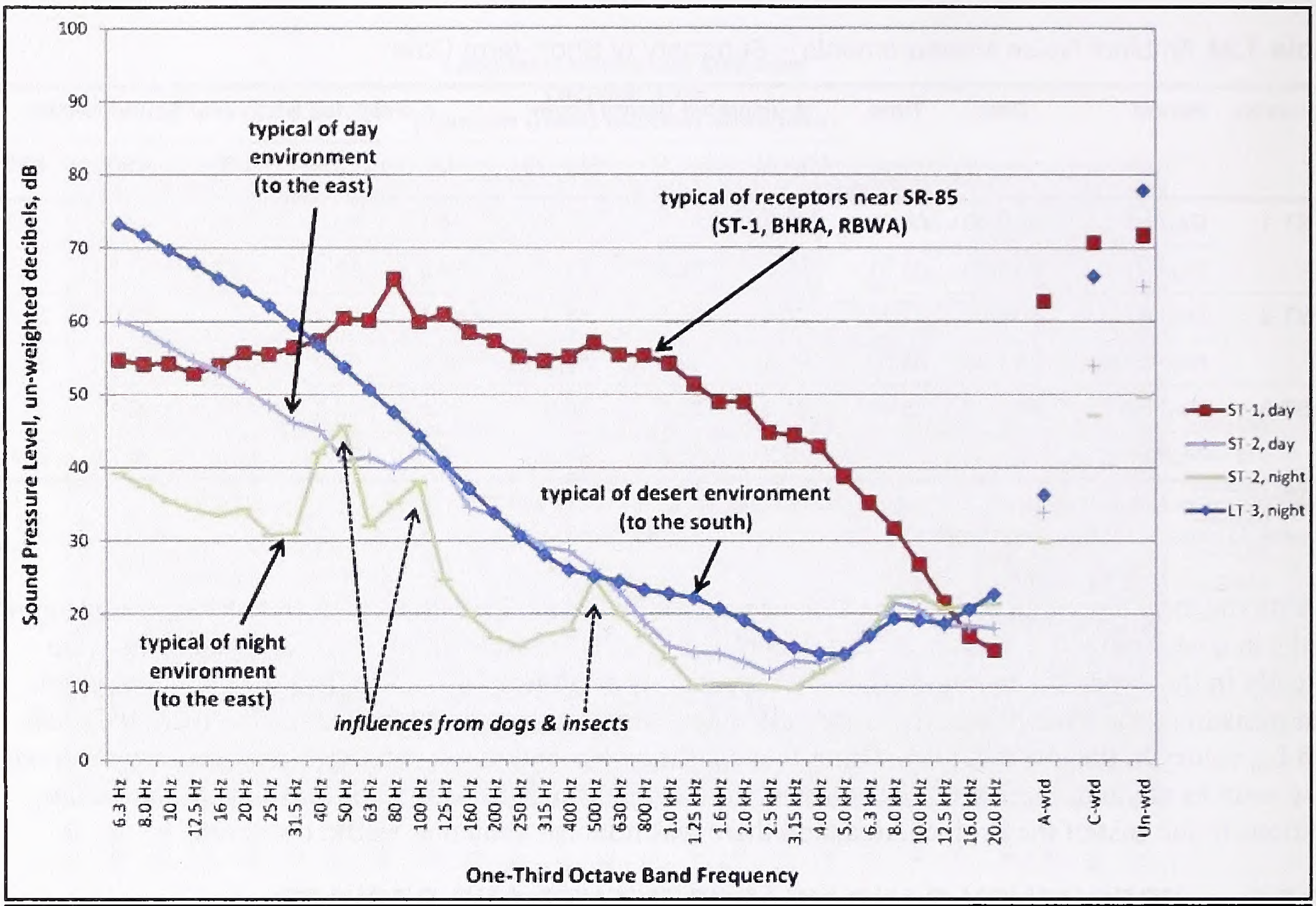

Figure 3.6 Typical ambient noise spectra.

Note: BHRA is referred to in the text as BHRP, or Buckeye Hills Regional Park.

3.9.6 Ambient Noise Summary

Field observations indicated that there are very few area-wide noise sources that are noteworthy (such as local traffic, industrial, commercial, or agricultural sources). The noise environments at the five residential/recreational measurement locations were very similar and are dominated by the general background noise effects during the majority of daytime hours. Typically, the lack of noise sources makes for the analysis area an extremely quiet environment. Even during these very quiet periods, the traffic on SR-85 (as exemplified by Location ST-1) was not audible, and the noise environment was mainly influenced by insects and distant dogs.

3.10 Paleontology

3.10.1 Overview

The SSEP would be located almost entirely on BLM-administered land south of the Buckeye Hills and the Town of Buckeye in Maricopa County, Arizona. The analysis area for paleontological resources lies in the Project Area boundary (see Section 3.1.1), because surface-disturbing activities that would affect fossils are limited to the Project Area.

3.10.2 Paleontological Potential

Information from the geological units and known fossil localities in the Phoenix metropolitan area were used to identify the paleontological potential in the Project Area. Paleontological potential levels have been assigned to each geological formation, based on discussions with paleontologists familiar with this area. The PFYC system was adopted by the BLM in 2007 for assessing paleontological potential on federal land (BLM 2007b). The PFYC system classifies geological units based on 1) the relative abundance of vertebrate fossils or of scientifically significant invertebrate and plant fossils and 2) the potential of these fossils to be adversely impacted. A higher class number indicates a higher potential for the presence of paleontological resources. This PFYC classification system is applied to the geological formation, member, or other distinguishable map unit, preferably at the most detailed mappable level. This system was followed in recognition of the direct relationship that exists between paleontological resources and the geological units in which fossils are entombed. Each PFYC class is defined in Table 3.25.

Table 3.25 Potential Fossil Yield Classification

Classification	Description
Class 1: Very Low Potential	These are geological units that are not likely to contain recognizable fossil remains. These units include igneous, metamorphic, and Precambrian rocks.
Class 2: Low Potential	These are sedimentary geological units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. These units include aeolian, diagenetically altered, and Holocene sediments.
Class 3: Moderate or Unknown Potential	These are fossil-bearing sedimentary geological units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.
Class 3a: Moderate Potential	These are units known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area.
Class 3b: Unknown Potential	These are units that exhibit geological features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or area is known. This may indicate the unit or area is poorly studied and field surveys may uncover significant fossils.
Class 4: High Potential	These are geological units that contain a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability.
Class 5: Very High Potential	These are highly fossil-bearing geological units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils.

Source: BLM (2007).

The Project Area is situated primarily on alluvial-fan deposits that are characteristic of the Little Rainbow Valley. The only geologic unit found in the Project Area is undivided Quaternary alluvium (Q). The likely source of this alluvial Quaternary-aged deposit is the Early Proterozoic granitic rock (Xg), which consists of igneous and metamorphic rocks that compose the core of the adjacent Buckeye Hills and Maricopa Mountains (AGS 2000; Cordiviola 1980). Additional information with respect to the geological unit in the Project Area is presented in Section 3.5 (Geology and Minerals).

The paleontological potential in the Project Area can be determined by integrating information from the Project Area's geological units with the paleontological resources inventory. To assess paleontological potential, the PFYC for each geological unit present in the Project Area is used. The only unit present is listed in Table 3.26 and illustrated on Map 16. Geological units with a PFYC of 3 to 5 would require monitoring during construction-related activities. Geological units with a PFYC of 1 or 2 would not require monitoring during construction-related activities. The entire Project Area has a PFYC 2 (Table 3.26) and a low paleontological potential rating (Kirby 2009b).

Table 3.26 Geological Units in the Project Area and their Potential Fossil Yield Classification and Paleontological Potential Rating

Geological Unit	Age	Acres	PFYC	Paleontological Potential Rating
Undivided Quaternary Alluvium (Q)	Pleistocene	3,702	2	Low

Undivided Quaternary alluvium is the principal valley-forming deposit in the Project Area. This deposit is middle to latest Pleistocene in age, or 250,000 years before present (B.P.) to 10,000 years B.P. (Demsey 1989). Surficial deposits generally consist of gravel lags, whereas subsurface deposits are characterized by well-sorted silt, sand, and gravel to cobbles. The undivided Quaternary deposits are assigned a PFYC level of 2 and are regarded as having low paleontological potential as the alluvial materials that comprise the geologic unit tends to move and do not bind to hold fossils in place. Intermittent deposits of cobble material would only require monitoring if they are encountered during construction activities.

3.11 Recreation and Wilderness Characteristics

3.11.1 Overview

The Project Area's limited recreational use includes mostly hiking, horseback riding, hunting, and motorized travel. However, the surrounding landscape accommodates many recreational uses. The Buckeye Hills Regional Park, the Sierra Estrella Wilderness, the Sonoran Desert National Monument, and the North Maricopa Mountains Wilderness are all located within 10 miles of the Project Area. The area of analysis for recreation and wilderness characteristics is not a defined polygon but rather any topographic point in these recreational areas where sights or sounds from the Project Area may be experienced by a visitor. Details about the area of analysis can be found in Chapter 4.

Although they are outside of the Project Area, these recreational areas or areas with wilderness characteristics may be impacted by project activities and would be considered in this analysis. Access to the analysis area could be affected by the construction and improvement of roads for the SSEP. There may also be visual and auditory impacts that could affect the visitor experience outside of the Project Area.

3.11.2 Laws, Ordinances, Regulations, and Standards

FLPMA (43 U.S.C. § 1701 et seq.) provides the authority for BLM land-use planning. It requires that public lands be managed in a manner that would protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, [the BLM] would preserve and protect certain public lands in their natural condition.

Section 201 of FLPMA requires BLM to prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values, which includes wilderness characteristics. Section 202 of FLPMA authorizes BLM to manage, as established through the land-use planning process, for the protection of recreational and wilderness values.

3.11.3 Recreation

For the purpose of recreation management, the BLM identifies public lands as either special recreation management areas (SRMA) or as ERMAs. SRMAs are areas where more intensive recreation management is needed because of their high usage, and where recreation is a principal management objective. ERMAs constitute all public lands outside of SRMAs and other special designation areas. ERMAs are areas where recreation is nonspecialized, dispersed, and does not require intensive management or developed facilities. Recreation may not be the primary management objective in ERMAs, and recreational activities are subject to few restrictions.

The BLM manages land in the Project Area as an ERMA. The Lower Gila South RMP (BLM 1985) describes recreational uses in the ERMA as providing dispersed, recreational opportunities such as rock climbing, hiking, hunting, camping, sightseeing, rock collecting, and OHV use (BLM 1988).

In addition, the BLM uses the ROS classifications to set recreation objectives for recreation management areas (Duncan 2009). Objectives are established to provide opportunities for desired recreation activities and to guide management of the setting needed to support those activities and the desired recreation experience.

The entire Project Area (approximately 3,620 acres) and the portions of the Sonoran Desert National Monument that are not designated wilderness (337,989 acres) are in the semiprimitive motorized category. The semiprimitive motorized objectives are established for areas typically characterized by a predominately unmodified, natural setting of moderate to large size. Activities include camping, hiking, climbing, photography, spelunking, hunting, and OHV use. The experience objective for this type of area provides for isolation from human civilization, a high degree of interaction with the natural environment, and a moderate degree of personal risk and challenge.

The Sierra Estrella Wilderness and the North Maricopa Mountains Wilderness are managed as primitive under ROS. The primitive management objective is given to areas typically characterized by a large area of about 5,000 acres or more, located at least 3 miles from the nearest point of motor vehicle access. It is essentially an unmodified natural landscape with little evidence of others and almost no on-site management controls. Activities include overnight backpack camping, nature study and photography, back-country hunting, horseback riding, wildlife observation, and hiking. The experience provides visitors with a chance to achieve solitude and isolation from human civilization, feel close to nature, and encounter a greater degree of personal risk and challenge (BLM 1995). The Buckeye Hills Regional Park, northwest of the Project Area is managed by Maricopa County. There are currently no designated trails in the park, although the *Buckeye Trails Master Plan* identifies multiple future trail corridors. The park is open to nonmotorized use, including hiking, bicycling, camping, and horseback riding. There is also a shooting range located in the park (Maricopa 2010).

3.11.4 Wilderness Characteristics

Section 201 of FLPMA requires BLM to prepare and maintain, on a continuing basis, an inventory of all public lands and their resource and other values, which includes wilderness characteristics (43 U.S.C. § 1711(a)). Inventories are completed to identify lands with wilderness characteristics and to provide consideration of those values in land-use planning. Inventories may also be completed to provide an assessment of the effects of an action on lands with wilderness characteristics. Areas with wilderness characteristics are lands outside of existing wilderness and WSAs that have been inventoried by BLM and found to have wilderness characteristics, as defined by Section 2(c) of the Wilderness Act or agency inventory policies. These areas are managed according to the prescriptions of the agency LUPs. For an area to have wilderness characteristics, it must meet the following criteria:

- **Naturalness**: The area must be in a generally natural condition.
- **Size**: The area must be at least 5,000 contiguous, roadless acres or large enough to preserve as wilderness.
- **Opportunities for solitude or primitive recreation**: The area must provide outstanding opportunities for solitude or a primitive or unconfined type of recreation.
- **Special features**: The area may contain ecological, geologic, or other features of scientific, scenic, or historic value.

The Project Area does not possess wilderness characteristics. BLM lands of sufficient size to meet the wilderness characteristics size criteria are not present due to roads that cross the BLM lands in and surrounding the Project Area. The Arizona Wilderness Coalition submitted a proposal in 2004 to the BLM LSFO to consider an area around Margie's Peak in the northwest part of the Sonoran Desert National Monument (southwest of the Project Area) as having wilderness character. The BLM has conducted a wilderness characteristics field inventory or assessment of this area and independently confirmed the presence of wilderness characteristics (BLM 2011). How the unit (13,427 acres) will be managed is currently under consideration in the revision of the LSFO's LUP.

3.12 Socioeconomics

3.12.1 Overview

The SSEP would be constructed in southwestern Maricopa County, as depicted in Map 17. Because the socioeconomic impacts would occur in both Maricopa County and the adjoining Pinal County, both counties are included in area of analysis for socioeconomics, hereafter referred to as the Socioeconomic Study Area (SESA) for the SSEP. A number of the closest communities are also addressed in the analysis, including the Town of Gila Bend, the City of Goodyear, and the Town of Buckeye. The Town of Buckeye has annexed the land on which most of the project facilities would be located.

3.12.2 Socioeconomic Conditions

3.12.2.1 POPULATION

Population estimates and projections for Pinal and Maricopa counties, and the closest towns and cities to the Project Area were collected from the U.S. Census Bureau (U.S. Census) and Maricopa Association of Governments (MAG 2007b), respectively. Table 3.27 summarizes these population figures. Maricopa County is the most populous county of Arizona's 15 counties, whereas Pinal County is the third most populous county in the state. These two counties comprise the Phoenix-Mesa-Scottsdale Metropolitan Statistical Area (Phoenix MSA). There have been no updates to these projections since 2007, and at this time, there are no other sources of population estimates and projections (personal communication, Anubhav Bagley 2009).

MAG assessed these population projections in 2007, prior to the current and recent economic downturn. Although the population projections were based on the best data available at the time, their accuracy is limited by three factors (Berger 2009). First, economic conditions in the area affect population totals. Second, migration (both domestic and international) to or from the area would affect the accuracy of population projections, which is often influenced by changing economic conditions. Finally, because the projections are based on the cities' LUPs, unforeseen changes in those LUPs might render the projections inaccurate (personal communication, Anubhav Bagley 2009). Population growth across the state has been slowing as a result of the economic downturn (Arizona Department of Commerce 2009c).

Table 3.27 Population Estimates and Projections

Area	2000	2005	2008	2010[2]	2020[2]	2030[2]
Phoenix MSA	3,251,876	3,883,892	4,281,899	–	–	–
Pinal County[1]	179,727	237,323	327,301	–	–	–
Maricopa	1,040	–	–	–	–	–
Casa Grande	25,224	–	–	–	–	–

Table 3.27 Population Estimates and Projections

Area	2000	2005	2008	2010[2]	2020[2]	2030[2]
Maricopa County[1]	3,072,149	3,646,569	3,954,598	4,216,499	5,230,300	6,135,000
Avondale	35,883	70,160	–	83,856	105,989	123,265
Buckeye	6,537	32,735	–	74,906	218,591	419,146
Gila Bend	1,980	2,118	–	2,575	3,950	9,074
Goodyear	18,911	47,520	–	71,354	174,521	299,397
Litchfield Park	3,810	6,787	–	8,587	10,305	10,510
Phoenix	1,321,045	1,510,177	–	1,695,549	1,990,450	2,201,843
Tolleson	4,974	6,491	–	7,748	9,646	10,193

[1] Data from U.S. Census (2009a, 2009b).

[2] The population projections for 2010, 2020, and 2030 are from MAG 2007b; the population estimate for the towns in Maricopa County for the year 2005 and for the projections into 2010 and beyond also come from MAG 2007b.

The population in Maricopa County was 3.1 million and grew 28% between 2000 and 2008, gaining nearly 900,000 residents over this period. The population of Pinal County was 179,727, growing 82% from 2000 to 2008, adding an additional 150,000 in population. Population growth rates for communities and counties in the SESA are summarized in Table 3.28. The communities of Buckeye, Goodyear, and Gila Bend are projected to grow substantially in population over the next 25 years; however, these population projections may be overestimated due to recent shifts in the economic vitality of the nation and region.

The communities closest to the Project Area are much smaller in population and more rural in nature than communities closer to Phoenix. For instance, Buckeye is less densely populated (92.9 people per square mile) compared to Goodyear, northeast of the site, which is much closer to the Phoenix metropolitan area (407.9 people per square mile).

Table 3.28 Population Growth Rates

Area	2000–2005	2005–2008	2005–2010	2010–2020	2020–2030
Phoenix MSA	19.4%	10.3%	–	–	–
Pinal County[1]	32.1%	37.9%	–	–	–
Maricopa	–	–	–	–	–
Casa Grande	–	–	–	–	–
Maricopa County[1]	18.7%	8.5%	15.6%	24.0%	17.3%
Avondale	95.5%	–	19.5%	26.4%	16.3%
Buckeye	400.8%	–	128.8%	191.8%	91.8%
Gila Bend	7.0%	–	21.6%	53.4%	129.7%
Goodyear	151.3%	–	50.2%	144.6%	71.6%
Litchfield Park	78.1%	–	26.5%	20.0%	2.0%
Phoenix	14.3%	–	12.3%	17.4%	10.6%
Tolleson	30.5%	–	19.4%	24.5%	5.7%

[1] Data from U.S. Census (2009a, 2000b) and MAG (2007b).

3.12.2.2 HOUSING

In 2000 there were 1,250,231 housing units in Maricopa County, 9.4% of which were vacant (U.S. Census 2009c). Between 2005 and 2007 the vacancy rate increased to 11.7% with approximately 174,000 units available in the county. In Pinal County during this period, there were 21,751 vacant housing units available. In Goodyear and Buckeye there were 1,929 and 865 housing units available on average between 2005 and 2007, respectively. Table 3.29 summarizes the housing characteristics of major population centers in the SESA during these two time periods.

In addition to local housing availability, there is ample short-term housing availability in the region in the form of hotels and motels. In 2009 there were 9, 21, and 10 hotels and motels in the communities of Buckeye, Goodyear, and Gila Bend, respectively, with many more hotel and motel accommodations available in the Phoenix metropolitan area.

There are approximately 30 widely dispersed parcels of low-density residential property that collectively contain approximately 50 individual residential units located within 2.0 miles east of the Project Area (see Section 3.7. Sixteen parcels are located within 1.0 mile of the eastern boundary of the Project Area. One of these is located within 0.1 mile of the Project Area boundary. Two dairies are located approximately 2.0 miles from the eastern Project Area boundary and are surrounded by agricultural lands.

Table 3.29 Housing Characteristics

Area	2000 Number of Units	2000 Vacant Units	2000 Percent Vacant	2005–2007 Number of Units	2005–2007 Vacant Units	2005–2007 Percent Vacant
Arizona State	2,189,189	287,862	13.1%	2,189,189	287,862	13.1%
Maricopa County	1,250,231	117,345	9.4%	1,492,572	173,949	11.7%
Avondale	11,419	779	6.8%	21,946	2,441	11.1%
Buckeye	2,344	186	7.9%	8,222	865	10.5%
Gila Bend	766	107	14.0%	n/a	n/a	n/a
Goodyear	6,771	592	8.7%	17,961	1,929	10.7%
Litchfield Park	1,633	125	7.7%	n/a	n/a	n/a
Phoenix	495,832	29,998	6.1%	543,568	5,653	11.0%
Tolleson	1,485	53	3.6%	n/a	n/a	n/a
Pinal County	81,154	19,790	24.4%	124,399	21,751	17.5%
Casa Grande	11,041	2,121	19.2%	18,956	2,572	13.6%
Maricopa City	329	37	11.2%	9,378	1,887	20.1%

Source: U.S. Census (2009c, 2009d).

Housing values, monthly mortgage costs, and monthly rental costs are generally lower in Gila Bend than in other communities near the Project Area. Buckeye generally has slightly lower housing values and costs when compared to Maricopa County, whereas Goodyear has slightly higher housing values and costs than those of the county. Pinal County's housing values are generally lower than those of Maricopa County. Table 3.30 summarizes these housing values and costs across the SESA. It should be noted that nationwide housing values have decreased since their peak in 2006. From 2007 to 2009, the median price of an existing home in Arizona decreased by 8% and up to 30% in some housing jurisdictions within the state (Arizona Department of Housing 2009).

Table 3.30 Housing Values and Costs

Area	2000 Median Housing Values	2005–2007 Median Housing Values	2000 Average Monthly Mortgage Costs	2005–2007 Average Monthly Mortgage Costs	2000 Median Monthly Gross Rental Costs	2005–2007 Median Monthly Gross Rental Costs
Arizona State	$121,300	$221,800	$1,039	$1,371	$786	$619
Maricopa County	$129,200	$248,800	$1,095	$1,470	$666	$845
Avondale	$129,200	$243,100	$1,141	$1,484	$583	$1,066
Buckeye	$86,400	$235,100	$919	$1,491	$433	$899
Gila Bend	$55,900	n/a	$663	n/a	$379	n/a
Goodyear	$156,800	$325,500	$1,195	$1,663	$793	$1,181
Litchfield Park	$169,400	n/a	$1,285	n/a	$795	n/a
Phoenix	$112,600	$230,300	$1,021	$1,402	$622	$778
Tolleson	$79,100	n/a	$986	n/a	$486	n/a
Pinal County	$93,900	$177,600	$894	$1,280	$509	$697
Casa Grande	$86,600	$166,900	$882	$1,260	$541	$736
Maricopa	$80,500	$261,000	$905	$1,671	$349	$1,322

Source: U.S. Census (2009c, 2009d); figures are in nominal dollars.

3.12.2.3 WAGES AND EMPLOYMENT

This section includes information on wages and employment for the State of Arizona, Maricopa County, Pinal County, and the Phoenix MSA. Table 3.31 shows the annual average wages by industry in the Phoenix MSA. The highest paying industries in 2008 in the Phoenix MSA were mining, real estate/rental/leasing, and professional, scientific, and technical services. The lowest annual average wages were in the following industries: accommodation and food services; arts, entertainment and recreation; and management of companies and enterprises.

Table 3.31 Annual Average Wages by Industry, Phoenix MSA 2008

Industry	Annual Average Wage
Accommodation and food services	$22,138
Administrative and Support and waste management	$40,323
Agriculture, forestry, fishing, and hunting	$41,835
Arts, entertainment, and recreation	$30,531
Construction	$48,399
Educational services	$40,323
Finance and insurance	$39,620
Health care and social assistance	$44,982
Information	$50,219
Management of companies and enterprises	$28,974
Manufacturing	$48,654
Mining	$70,334
Other services (except public administration)	$33,206
Professional, scientific, and technical services	$52,233
Public administration	$48,050
Real estate and rental and leasing	$57,820
Retail trade	$44,211
Transportation and warehousing	$47,914
Utilities	$40,861
Wholesale trade	$30,971

Source: Arizona Department of Commerce (2009a).

Table 3.32 and Table 3.33 summarize the employment by industry for Maricopa and Pinal counties, respectively. As of 2009 total employment in Maricopa County was 1.7 million, rising approximately 9% between 2001 and 2009. This was driven by growth in education and health services, other services, and leisure and hospitality industries. Declining employment during this period was in information, manufacturing, mining, and construction industries. The largest industries in Maricopa County were professional and business services and government.

Total 2009 employment was 49,625 in Pinal County, up 30% from 2001. Since 2000 all sectors in Pinal County have experienced growth in employment, with the largest growth over this time period in financial activities (73%); trade, transportation, and utilities (35%); mining and construction (33%); and educational and health services (33%). From 2001 to 2007 almost all of these industries experienced employment declines, with the exception of government and professional and business services. The government sector in Pinal County is the largest employer in the region, accounting for 39% of employment.

Table 3.32 Nonfarm Employment by Industry for Maricopa County, 2001–2009

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2009 Percent Employment	2001–2009 Percent Change
Educational and health services	140.8	149.6	156.7	169.6	180.0	192.2	201.9	212.9	212.0	13%	51%
Financial activities	128.8	130.4	132.9	137.7	146.0	152.2	152.1	146.2	140.5	8%	9%
Government	188.6	197.1	200.6	204.5	208.8	211.7	219.9	225.2	219.4	13%	16%
Information	41.3	39.1	37.2	34.3	33.0	32.0	30.8	31.2	30.2	2%	-27%
Leisure and hospitality	149.5	150.5	152.9	158.3	166.6	176.2	181.6	180.9	177.2	10%	19%
Manufacturing	150.3	135.0	128.3	129.0	133.1	136.2	133.3	127.4	120.6	7%	-20%
Mining and construction	127.8	125.7	128.9	140.9	163.2	179.2	168.4	140.0	106.1	6%	-17%
Other Services	58.0	60.4	61.3	62.9	64.7	69.4	70.4	72.5	69.3	4%	19%
Professional and business services	256.2	250.3	255.6	270.8	293.4	315.9	321.4	304.4	272.3	16%	6%
Trade, transportation, and utilities	318.2	319.0	321.5	333.2	354.4	371.1	383.0	374.0	350.0	21%	10%
Total	**1,559.5**	**1,556.9**	**1,575.8**	**1,641.2**	**1,743.0**	**1,836.0**	**1,862.8**	**1,814.7**	**1,697.6**	**100%**	**9%**

Source: Arizona Department of Commerce (2009b).

Note: Data in this table are in thousands, rounded to the nearest hundred.

Table 3.33 Nonfarm Employment by Industry for Pinal County, 2001–2009

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2009 Percent Employment	2001–2009 Percent Change
Educational and health services	2,875	3,450	3,825	4,000	4,025	4,100	4,200	3,950	3,825	8%	33%
Financial activities	825	850	850	900	1,025	1,200	1,500	1,525	1,425	3%	73%
Government	14,850	15,575	15,925	16,200	16,775	17,575	19,050	20,175	19,275	39%	30%
Information	300	300	300	300	300	325	375	375	350	1%	17%
Leisure and hospitality	2,975	2,950	3,175	3,550	3,850	4,225	4,575	4,025	3,600	7%	21%
Manufacturing	2,850	2,525	2,600	2,925	3,400	3,700	3,950	3,825	3,525	7%	24%
Mining and construction	2,900	2,650	2,400	2,675	2,850	3,650	4,225	4,450	3,850	8%	33%
Other services	1,275	1,225	1,250	1,275	1,350	1,575	1,625	1,625	1,375	3%	8%
Professional and business services	3,200	3,200	2,975	2,975	3,475	3,325	3,900	4,425	4,100	8%	28%
Trade, transportation, and utilities	6,150	6,500	7,150	7,425	7,675	8,400	8,775	9,025	8,300	17%	35%
Total	**38,200**	**39,225**	**40,450**	**42,225**	**44,725**	**48,075**	**52,175**	**53,400**	**49,625**	**100%**	**30%**

Source: Arizona Department of Commerce (2009b).

Employment figures for the communities in Maricopa County are shown in Table 3.34. Of the three closest cities or towns to the Project Area, Goodyear had the largest employment base in 2005 (15,794). For Goodyear, 27% of the employment is classified as "other" (primarily construction employment), followed by 26% in retail, and 24% in industrial occupations. Total employment in Buckeye in 2005 was 8,672, which consisted of 42% "other" (primarily construction), 29% public (e.g., government), and 15% industrial employment. Employment in Gila Bend was 1,077 in 2005, which consisted of 36% retail and 30% public employment.

Table 3.34 2005 Employment by Sector for Selected Cities in Maricopa County

Area	Total	Retail	Office	Industrial	Public	Other*
Avondale	12,315	5,656 (46%)	312 (3%)	537 (4%)	3,371 (27%)	2,439 (20%)
Buckeye	8,672	1,124 (13%)	78 (1%)	1,259 (15%)	2,537 (29%)	3,674 (42%)
Gila Bend	1,077	388 (36%)	0 (0%)	231 (21%)	319 (30%)	139 (13%)
Goodyear	15,794	4,029 (26%)	233 (1%)	3,838 (24%)	3,497 (22%)	4,197 (27%)
Litchfield Park	1,710	257 (15%)	34 (2%)	4 (0%)	466 (27%)	949 (55%)
Phoenix	811,513	168,457 (21%)	241,904 (30%)	169,419 (21%)	106,852 (13%)	124,881 (15%)
Tolleson	12,340	1,520 (12%)	53 (0%)	8,302 (67%)	1,707 (14%)	758 (6%)

Source: MAG (2007b).
*Other employment includes work-at-home and construction employment.

Maricopa County has been especially hard hit by the economic downturn, leading the nation in job losses and housing foreclosures, along with Las Vegas, Nevada and Riverside, California (Hoffman and McPheters 2009). Turmoil in the financial markets has severely affected the cost and availability of credit to both households and businesses, affecting the housing market and construction industries (Bernanke 2009).

Historical and projected employment is provided for the Phoenix MSA in Table 3.35. Between 2008 and 2010 the construction industry is expected to lose approximately 32,500 jobs. The financial activities sectors are estimated to lose 6,700 jobs during this time period. Total employment in the Phoenix MSA is between 2008 and 2010 and is expected to decrease by 128,300 jobs. Similarly, the unemployment rate (the percentage of people who are unemployed and seeking work) has risen in the Phoenix MSA from 5.1% in July 2008 to 8.4% in July 2009 (Arizona Department of Commerce 2009c).

Table 3.35 Employment by Industry for the Phoenix MSA, 2001–2009 (annual percentage change in parentheses)

Industry	2006	2007	2008	2009 Projected	2010 Projected
Construction	180.1 (9.9%)	169.4 (-5.9%)	140.7 (-16.9%)	110.5 (-21.5%)	108.2 (-2.0%)
Educational and health services	196.3 (6.6%)	206.2 (5.0%)	216.9 (5.2%)	219.5 (1.2%)	222.4 (1.3%)
Financial activities	153.4 (4.4%)	153.6 (0.1%)	147.8 (-3.8%)	142.6 (-3.5%)	141.1 (-1.1%)
Government	229.2 (1.6%)	238.7 (4.1%)	245.5 (2.8%)	240.2 (-2.1%)	238.6 (-0.7%)
Information	32.4 (-2.7%)	31.2 (-3.7%)	31.6 (1.3%)	30.1 (-4.6%)	29.6 (-1.8%)
Leisure and hospitality	180.5 (5.9%)	186.2 (3.2%)	184.9 (-0.7%)	178.2 (-3.6%)	177.0 (-0.7%)
Manufacturing	139.9 (2.5%)	137.2 (-1.9%)	131.2 (-4.4%)	129.9 (-5.6%)	121.4 (-2.0%)
Natural resources and mining	2.7 (22.7%)	3.2 (18.5%)	3.7 (15.6%)	3.5 (-6.0%)	3.4 (-2.0%)
Other services	71.0 (7.6%)	72.1 (1.5%)	74.1 (2.8%)	71.1 (-4.0%)	71.8 (1.0%)
Professional and business services	319.2 (7.5%)	325.3 (1.9%)	308.9 (-5.0%)	283.9 (-8.3%)	278.6 (-1.7%)
Trade, transportation, and utilities	379.5 (4.8%)	391.7 (3.2%)	383.0 (-2.2%)	354.8 (-7.4%)	347.8 (-2.0%)
Total nonfarm employment	**1,884.1 (5.4%)**	**1,914.9 (1.6%)**	**1,868.3 (-2.4%)**	**1,757.8 (-5.9%)**	**1,739.9 (-1.0%)**

Note: Data in this table are in thousands, rounded to the nearest hundred.
Source: Arizona Department of Commerce (2009c).

3.12.2.4 INCOME

In 2000 the Town of Gila Bend and the City of Maricopa had the lowest median household and per-capita income levels compared to other communities in Maricopa and Pinal counties. The City of Goodyear had a higher median household income compared to the two counties and to the state, although the city's per-capita income levels were fairly consistent with those of Maricopa County. In 2000 Litchfield Park had much higher income levels compared to adjacent communities in the SESA. The Town of Buckeye had lower per-capita income levels compared to those of Maricopa County, but had consistent median household income levels with the county in 2007. These figures are summarized in Table_3.36.

Table 3.36 Median Household Income and Per Capita Income (2009$)

Area	2000 Median Household Income	2005–2007 Median Household Income*	2000 Per Capita Income	2005–2007 Per Capita Income*
Arizona State	$51,888	$49,968	$25,939	$25,274
Maricopa County	$58,029	$55,046	$28,467	$27,251
Avondale	$62,884	$60,277	$21,645	$21,446
Buckeye	$45,267	$56,392	$19,992	$20,149
Gila Bend	$34,408	n/a	$13,808	n/a
Goodyear	$73,552	$76,224	$28,793	$28,278
Litchfield Park	$91,953	n/a	$48,350	n/a
Phoenix	$52,718	$48,543	$25,373	$24,022
Tolleson	$49,604	n/a	$17,587	n/a
Pinal County	$45,872	$46,293	$20,502	$21,407
Casa Grande	$47,607	$42,669	$20,363	$20,427
City of Maricopa	$39,180	$70,323	$11,738	$31,880

Source: U.S. Census (2009e, 2009f).

Note: Figures were adjusted for inflation using the Consumer Price Index published by the U.S. Bureau of Labor Statistics and are reported in 2009 dollars.

*The 2005–2007 American Community Survey 3-year estimates are based on data collected between January 2005 and December 2007.

3.12.2.5 QUALITY OF LIFE CONDITIONS

Population, housing, and income statistics provide a cursory glimpse of the sociologic conditions in any given area. In order to gain a deeper sense of the communities closest to the Project Area (those likely to be most directly impacted by the SSEP), it is necessary to look at additional, local, long-range planning documents, the public scoping report, and other affected environment resource sections in this document.

The communities closest to the Project Area, Buckeye and Goodyear, have historically been considered rural with a farming and ranching-based economy (Town of Buckeye 2008a, City of Goodyear 2003; see Map 11). However, with tremendous population growth in the past decade, these rural to moderately developed communities are poised to become socially and economically diverse bedroom communities of the Phoenix metropolitan area. According to each communities' general plan, the local residents are interested in maintaining the traditional values of a rural western community (e.g., independence, free enterprise, community involvement) while fostering sustainable growth and constructive values. Although the communities would like to invite a multifaceted economic base to the area that would allow residents to live, work, and recreate in these cities, they would also like to maintain the historical connections to the agricultural, visual, and physical landscape characteristics of the past.

The 2005 *Buckeye Parks, Trails and Open Spaces Master Plan* suggests an active population that considers recreation, parks, and trails as important components in their community. The Town of Buckeye has emphasized the importance of viewsheds and connectivity to regional parks, national monuments, and riverways and identifies them as important features of their community (Town of Buckeye 2005). Nearby opportunities for recreation include the 487,000-acre Sonoran Desert National Monument. It is located 1 mile south of the Project Area and is home to recreational activities, including hiking, backpacking, star-gazing, camping, hunting, motor touring, sightseeing, photography, and horseback riding. The North Maricopa Mountain Wilderness is located approximately 3 miles south of the

Project Area and the Buckeye Hills Recreation Area and Robbins Butte Wildlife Area are located northwest of the Project Area. For more information on the recreation opportunities of the area, see Section 3.11.

Current traffic and noise conditions also provide a snapshot of local community characteristics. A recently completed traffic study of the area around the Project Area found that there is little to no traffic during morning and afternoon peak hours. The lack of congestion, even at unsignalized intersections, reflects the rural sense of community. For more detail on traffic and transportation see Section 3.15. To further emphasize the rural nature of the Project Area, recent noise studies conducted in and near the Project Area found the noise environment to be extremely quiet (see Section 3.9).

3.12.3 Fiscal Conditions

Maricopa County: There are three funds that Maricopa County uses for its operations: General Operations Fund; the Detention Operations Fund; and the County Improvement Debt Fund. Table 3.37 shows the total revenues, by category, associated with each fund at the end of the 2007–2008 fiscal year. The significant revenue sources for these funds include taxes (65%) (county-levied, general sales, and vehicle license taxes), charges for services (14%), and operating grants (13%) of total governmental revenues for Fiscal Year 2008.

Table 3.37 2007–2008 Maricopa County Revenues (thousands)

Revenue	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Charges for services	$42,716	$33,047	$3,055
Fines and forfeits	$16,902	–	–
Intergovernmental	$614,212	$2,926	–
Licenses and permits	$1,668	–	–
Miscellaneous	$32,663	$9,944	$2,201
Special assessments	–	–	–
Taxes	$439,936	$138,064	–
Total revenues	**$1,148,097**	**$183,981**	**$5,256**

Source: Maricopa County Department of Finance (MCDF) (2008).

Table 3.38 shows the expenses associated with these accounts for the 2007–2008 fiscal year (July 1 through June 30). Public safety, and health, welfare, and sanitation comprise the largest expenditure items in Maricopa County.

Table 3.38 Maricopa County Expenditures for 2007–2008 Fiscal Year (thousands)

Expense	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Current			
General government	$166,959	–	–
Public safety	$445,647	$299,735	–
Highways and streets	–	–	–
Health, welfare, and sanitation	$239,742	–	–

Table 3.38 Maricopa County Expenditures for 2007–2008 Fiscal Year (thousands)

Expense	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Culture and recreation	$1,761	–	–
Education	$2,273	–	–
Debt Service			
Principal	–	–	$12,621
Interest	–	–	$8,972
Other expenditures	–	–	$4
Capital outlay	$45,756	$10,441	–
Total expenditures	**$902,138**	**$310,176**	**$21,597**
Difference Between Revenue (Table 3.37) and Expenditures (Table 3.38)	$245,960	-$126,195	-$16,341

Source: MCDF (2008).

Pinal County: The Pinal County Finance Department describes county governmental revenues and expenditures within five funds. The General Fund is the primary operating fund for Pinal County (Pinal County 2009). The Public Works Highway Fund was established to fund road maintenance and operations, pavement preservation, and fleet services. The Road Tax Districts Fund exists on revenues generated via the Pinal County Transportation Excise Tax and funds construction, maintenance, repair, and development of county roads, streets, and bridges. Development impact fees assessed on all new developments in unincorporated areas in the county support parks, streets, and public safety programs, and contribute to the Development Impact Fee fund. In addition, there are other governmental funds, such as major enterprise funds, internal service funds, investment trust funds, and agency funds (Pinal County 2009). Table 3.39 and Table 3.40 summarize the Pinal County revenues and expenditures, respectively.

Table 3.39 Pinal County Revenues for the 2007–2008 Fiscal Year (thousands)

Revenue	General Fund	Public Works Highway Fund	Road Tax Districts Fund	Development Impact Fee Fund	Other Governmental Funds	Total
Charges for services	$17,666	$1	–	$10,122	$7,496	**$35,285**
Contributions	$20	$10	$80	–	$2,498	**$2,608**
Fines and forfeits	$2,087	–	–	–	$1,377	**$3,464**
Intergovernmental	$37,209	$22,505	$143	–	$32,257	**$92,114**
Investment earnings	$1,844	$481	$835	$629	$2,795	**$6,584**
Licenses	$3,544	–	–	–	$2,252	**$5,796**
Miscellaneous	$594	$153	–	–	$4,301	**$5,048**
Rentals	$40	–	–	–	$751	**$791**
Taxes	$92,540	–	$6,308	–	$10,594	**$109,442**
Total revenues	**$155,544**	**$23,150**	**$7,366**	**$10,751**	**$64,321**	**$261,132**

Source: Pinal County (2009).

Table 3.40 Pinal County Expenditures for the 2007–2008 Fiscal Year (thousands)

Expense	General Fund	Public Works Highway Fund	Road Tax Districts Fund	Development Impact Fee Fund	Other Governmental Funds	Total
Current						
General government	$71,154	–	–	–	$1,807	**$72,961**
Public safety	$60,880	–	–	–	$21,443	**$82,323**
Highways and streets	–	$25,230	$3,809	–	$7,220	**$36,259**
Sanitation	$486	–	–	–	$415	**$901**
Health	$19,864	–	–	–	$10,608	**$30,472**
Welfare	$932	–	–	–	$5,028	**$5,960**
Culture and recreation	$128	–	–	–	$1,269	**$1,397**
Education	$747	–	–	–	$9,624	**$10,371**
Debt Service						
Principal retirement	$10	$712	–	–	$6,898	**$7,620**
Interest	$2	$145	–	–	$7,486	**$7,633**
Costs of issuance	$86	–	–	–	–	**$86**
Miscellaneous	–	–	–	–	$11	**$11**
Capital outlay	–	–	–	–	$19,760	**$19,760**
Total expenditures	**$154,289**	**$26,087**	**$3,809**	**–**	**$91,569**	**$275,754**
Difference Between Revenue (Table 3.39) and Expenditures (Table 3.40)	$1,255	$-2,937	$3,557	$10,751	$-27,248	-$14,622

Source: Pinal County (2009).

3.12.4 Public Services and Utilities

3.12.4.1 EMERGENCY SERVICES

Fire and medical emergencies in the Project Area would be serviced by the Town of Buckeye Fire Department. The department has six fire stations, each having its own fire truck. The department does not own any ambulances; however, paramedics are always sent out as part of the team responding to calls.

In the event that an ambulance is needed, the main dispatch center (in Phoenix) would dispatch an ambulance from the Buckeye Valley Fire District (separate from the Buckeye Fire Department). In most cases, patients needing hospitalization would be taken to the closest hospital, the West Valley Hospital in Goodyear, approximately 38 miles from the Project Area. Patients may also be taken to the Estrella Hospital in Phoenix. For most medical emergencies in the Project Area, dispatchers would immediately send an ambulance along with the fire truck, due to the distance from Buckeye (personal communication, Erica Van Valkenburg 2009).

Law enforcement services for the SSEP would be provided by the Buckeye Police Department, which currently has one main station and 70 officers (personal communication, Don Homan 2009).

3.12.4.2 ELECTRICITY AND NATURAL GAS

APS is Arizona's largest electricity utility, and it serves more than one million customers in 11 of the state's 15 counties; this includes service in Goodyear, Gila Bend, and Buckeye. Southwest Gas Corporation provides natural gas to customers in this region.

3.12.4.3 WATER AND WASTEWATER

Gila Bend, Goodyear, and Buckeye each have their own water departments that oversee water supply and wastewater services. The Gila Bend Municipal Water Department oversees the provision of water supply and the treatment of wastewater. The total number of water supply service connections is approximately 800 for approximately 1,800 people. Gila Bend pumps its own water, sends it to a treatment plant that reduces the water's naturally high fluoride content, and then distributes it to consumers.

The Goodyear Public Works and Water Resources Department oversees water supply and wastewater services in Goodyear, supporting 50,000 individuals. There are three wastewater treatment plants, for which the total capacity is 5.5 million gpd (personal communication, Reuben Zaloz 2009).

Buckeye's Department of Water Resources oversees water production, treatment, and distribution, as well as wastewater treatment. Buckeye's water is supplied by groundwater pumped from the West Salt River Valley Sub-basin and the Hassayampa Sub-basin (Town of Buckeye 2008b). Storage reservoirs supply water to over 9,000 customers. The town also provides flood irrigation to 460 customers. Buckeye has four wastewater treatment facilities, with a capacity of 7.2 million gpd (Town of Buckeye 2009).

3.12.4.4 SOLID WASTE

Solid waste services in Gila Bend are overseen by the Gila Bend Municipal Water Department. Trash generated in Gila Bend is delivered to a landfill in Buckeye, Arizona. This sanitary landfill, the Southwest Regional Landfill, is located directly west of SR-85 and the Project Area. Gila Bend does not have recycling, hazardous waste, or any other types of special solid waste programs (personal communication, Joanne Carpenter 2009).

In Goodyear, solid waste services are managed by the Goodyear Public Works and Water Resources Department and contracted to Waste Management Services, which owns eight garbage trucks. These trucks serve approximately 20,000 households and businesses. Trash is taken to a landfill in Surprise, Arizona approximately 50 miles north of the Project Area; recycling services are also overseen by Waste Management (using two recycling trucks), and the recycling facilities are located in downtown Phoenix.

The Goodyear Public Works and Water Resources Department had a hazardous waste management program, but did not have the budget to support it. Households with hazardous waste now make their own arrangements with contractors (personal communication, Willy Alizondo 2009).

The Southwest Regional Landfill, located approximately 3 miles west of the Project Area, is the closest landfill to the Project Area and the only landfill in the Town of Buckeye. The landfill currently has abundant capacity to accommodate additional debris (personal communication, Kathy Lugo 2009).

3.12.4.5 SCHOOLS

There are a number of school districts in the communities of Buckeye, Gila Bend, and Goodyear. The Project Area is located in the Buckeye Union High School District of Maricopa County, which has four high schools. Buckeye Academy is a special learning center for which students from the other three schools must apply independently. For this reason, the total number of students enrolled in the Buckeye

Academy is inclusive of the total number of students enrolled in the other three schools, and no student figures are given for the Buckeye Academy. This district encompasses the elementary school districts of Arlington, Buckeye, Liberty, and Palo Verde. Between the four elementary school districts, there are 14 elementary schools, which host kindergarten through eighth grade. A summary of school information and enrollment for the Buckeye schools is provided in Table 3.41.

Table 3.41 Summary of Schools in the Buckeye Union High School District

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year	Notes on Enrollment
Buckeye Union High School District	Buckeye Union	9–12	1,504	Enrollment in these schools is growing; however, this enrollment growth is lower than rates experienced in previous years. Growth has been 18% per year in the past, but for 2009 to 2010 it was approximately 7%. School officials believe this is due to residents leaving the district.
	Estrella Foothills	9–12	988	
	Youngker High School	9–11	1,127	
	Buckeye Academy	9–12	n/a	
Arlington Elementary School District	Arlington Elementary	Kindergarten –8 (K–8)	280	Enrollment is increasing in this school, with 2009–2010 school year showing growth that has been typical of the past 5 years.
Buckeye Elementary School District	Buckeye Primary	K–4	610	Enrollment for the 2009–2010 school year is approximately the same as that of the 2008–2009 school year, indicating no growth in student enrollment. In recent years, there have been increases in enrollment. Enrollment growth is expected to occur as the school year progresses.
	Buckeye Middle	5–8	330	
	Bales Elementary	K–8	704	
	Steven R. Jasinski	K–8	768	
	Inca Elementary	K–8	647	
	Sundance Elementary	K–8	836	
	West Park Elementary	K–8	584	
Liberty Elementary School District	Estrella Mountain Elementary	K–8	Approx. 700 students per school	Enrollment for the 2009–2010 school year in this district has declined by approximately 180 students. In recent years, enrollment has grown by 5% to 10% per year.
	Freedom Elementary	K–8		
	Liberty Elementary	K–8		
	Rainbow Valley Elementary	K–8		
	Westar Elementary	K–8		
Palo Verde Elementary School District	Palo Verde Elementary	K–8	500	Enrollment for the 2009–2010 school year has been higher than average (30%–35% new students, whereas 20% would be typical)

Source: Personal communication, Marsha Conner (2009); Nancy Eaton (2009); Jodi Obenstein (2009); Candy Rio (2009); and Chad Turner (2009).

The City of Goodyear is served by two school districts: the Agua Fria Union High School District and the Avondale Elementary District. Both of these districts include schools that are in Goodyear, as well as Avondale and Buckeye. High schools in the Agua Fria Union High School District are also fed by graduates from the Litchfield Park Elementary District; for this reason, Table 3.42 includes a description of the schools in Litchfield Park, as well as those in the City of Goodyear.

Table 3.42 Summary of Schools in the Agua Fria Union High School District

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year	Location of School
Agua Fria Union High School District	Agua Fria High School	9–12	1,798	Avondale
	Desert Edge High School	9–12	1,597	Goodyear
	Millennium High School	9–12	1,751	Goodyear
	Verrado High School	9–12	294	Buckeye
Avondale Elementary District	Centerra Mirage	K–8	800	Goodyear
	Desert Star	K–8	981	Goodyear
	Desert Thunder	K–8	937	Goodyear
	Eliseo C Felix School	K–8	665	Goodyear
	Lattie Coor School	K–8	1,232	Avondale
	Michael Anderson	K–8	873	Avondale
	Wildflower School	K–8	618	Goodyear
Litchfield Elementary District	Barbara B. Robey Elementary School	PreK–5	780	Litchfield Park
	Corte Sierra Elementary School	PreK–6	854	Litchfield Park
	Litchfield Elementary School	K–5	869	Litchfield Park
	Palm Valley Elementary	PreK–6	881	Litchfield Park
	Rancho Santa Fe Elementary School	K–8	881	Litchfield Park
	Scott L. Libby Elementary School	K–6	710	Litchfield Park
	Verrado Middle School	K–8	1,102	Litchfield Park
	Western Sky Middle School	6–8	927	Litchfield Park
	White Tanks Learning Center	K–8	20	Litchfield Park
	Wigwam Creek Middle School	6–8	1,111	Litchfield Park

Source: Personal communication, Rita Hagen (2009); National Center for Education Statistics (2009).

All of the schools in the Gila Bend Unified High School District and the Paloma Elementary District are located in Gila Bend. Graduates from the Paloma Elementary District attend Gila Bend High School. Gila Bend school information and enrollment is summarized in Table 3.43.

Table 3.43 Summary of School Districts in Gila Bend

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year
Gila Bend Unified District	Gila Bend High School	9–12	167
	Gila Bend Elementary	K–8	331
Paloma Elementary District	Paloma Elementary School	K–8	79

Source: Personal communication, Burma Garcia (2009); personal communication, Peggy Carey (2009).

3.12.5 Environmental Justice

Consideration of environmental justice (EJ) issues is mandated by EO 12898, which was published on February 11, 1994. This EO requires that all federal agencies incorporate EJ into their mission by "identifying and addressing...disproportionately high and adverse human health or environmental effects of [their] programs, policies and activities on minority and low-income populations in the United States" (EPA 1994). The goal of the EO is to ensure that 1) all people are treated fairly with respect to the development and enforcement of protective environmental laws, regulations, and policies; and 2) potentially affected community residents are meaningfully involved in the decisions that would affect their environment and/or their health. Conversely, allegations of environmental injustice refer to situations in which these social justice goals have not been met, indicating a perceived disproportionate exposure to environmental harms and risks. Examples of such risks may include health concerns (such as those associated with indoor and outdoor air quality issues, water quality issues, noise, and others), impacts to livelihood and subsistence, and/or other impacts to human health and prosperity.

The EPA defines a community with potential EJ populations as one that has a greater percentage of minority or low-income populations than does an identified reference community. Minority populations are those populations having 1) 50% minority population in the affected area or 2) a significantly greater minority population than the reference area (EPA 1998a). The EPA has not specified what percentage of the population can be characterized as "significant" in order to define EJ populations. Therefore, for the purposes of this analysis, a conservative approach is used to identify potential EJ populations; it is assumed that if the affected area minority and/or poverty status populations are more than 10 percentage points higher than those of the reference area, there is likely an EJ population of concern. Low income populations were defined as those individuals that are considered living below poverty levels. The U.S. Census Bureau defines poverty level thresholds for individuals and a family of four as income levels below $8,501 and $17,029, respectively (U.S. Census 2003).

Typically, the EJ analysis is undertaken at the census block group level, which allows an assessment of both poverty and minority populations. However, due to the rural nature of the region, the census block groups encompass a large area and do not provide the detail needed to understand the potentially affected populations near the Project Area. Therefore, it was necessary to analyze populations in census blocks, which provides a more-detailed assessment on populations closest to the Project Area. A census block group is made up of census blocks. However, at the census block level only minority information was available, whereas poverty data were not available. Therefore, the EJ populations identified for this analysis were based solely on minority statistics.

The reference areas were determined to be Maricopa County and the State of Arizona, which are larger geographic areas with which to compare the census blocks. Relevant ethnicity data for the census blocks were used to determine whether populations residing in the affected area constitute a potential EJ population. This was done by comparing minority statistics for the blocks with those reported for

Maricopa County and the State of Arizona. The most current data available at the census block level were from 2000.

A potential EJ population was determined to exist in certain census blocks if the minority population (i.e., a nonwhite population) is more than 10 percentage points higher than the minority population in one of the reference communities (Maricopa County or the State of Arizona). Map 18 shows the potential EJ populations based on minority population percentages in the census blocks within the 5-mile radius of the Project Area. This includes census blocks that had more than 20 residents as measured by the 2000 Census. Within each census block, the minority populations range from 31 to 125 residents, and there are a total of 612 minority residents within the 5-mile radius of the Project Area. Table 3.44 summarizes these racial proportions for the relevant census blocks.

As shown in Map 18, the potential EJ populations located closest to the Project Area are directly north and slightly east of the Project Area. There are nine census blocks with potential EJ populations within 5 miles of the Project Area. These potential EJ populations have larger proportions of African American, Hispanic or Latino, Native American, or some other race when compared to populations in Maricopa County and the State of Arizona (U.S. Census 2009g). The purple and red highlighted census blocks indicate a greater proportion of minority residents or the existence of more than one minority group (e.g., Hispanic or Latino and Native American). The closest census block with a potential EJ population is approximately 2 miles north of the Project Area.

Table 3.44 2000 Ethnicity Percentages for Blocks of Potential Environmental Justice Populations

Race or Population	United States	State of Arizona	Maricopa County	Census Block 1055	Census Block 1051	Census Block 1054	Census Block 1077	Census Block 1029	Census Block 1030	Census Block 1045	Census Block 1053	Census Block 1037
White	75.10%	75.46%	77.32%	38.84%	64.17%	78.04%	61.95%	76.92%	82.50%	70.00%	69.23%	67.24%
Black or African American	12.21%	3.01%	3.63%	14.05%	0.00%	0.00%	1.09%	0.00%	0.00%	26.67%.	0.00%	0.00%
American Indian and Alaska Native	0.87%	4.94%	1.80%	5.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.08%	13.79%
Asian	3.61%	1.78%	2.16%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Native Hawaiian and other Pacific Islander	0.13%	0.12%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Some other race	5.49%	11.64%	11.89%	41.32%	35.82%	21.95%	36.96%	23.08%	17.50%	3.33%	27.69%	18.97%
Hispanic or Latino	12.52%	25.25%	24.85%	46.40%	35.82%	46.34%	65.31%	30.59%	35.71%	19.35%	33.85%	20.69%
Total population	**281,421,906**	**5,130,632**	**3,072,149**	**125**	**67**	**41**	**98**	**85**	**42**	**31**	**65**	**58**

Note: According to the 2000 Census, a person may identify themselves as falling within one of six race categories shown in the table above. People who identify with the terms "Hispanic" or "Latino" are identifying their origin, heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. Someone who identifies themselves as Spanish, Hispanic, or Latino can be of any race.

Source: U.S. Census (2009h).

As indicated above, the most recent population data available at the census block level are from the 2000 Census. Recent changes in ethnicity around the Project Area were assessed by comparing 2000 Census data and 2008 data from the Census Bureau's Population Estimates Program in Maricopa County. Table 3.45 highlights the percentage changes in ethnicity.

Table 3.45 2000 and 2008 Ethnicity Percentages in Maricopa County

Race or Population	2000	2008
White	77.32%	80.4%
Black or African American	3.63%	4.30%
American Indian and Alaska Native	1.80%	1.80%
Asian	2.16%	2.90%
Native Hawaiian and other Pacific Islander	0.12%	0.20%
Some other race	11.89%	8.20%
Hispanic or Latino	24.85%	30.30%
Total population	**3,072,149**	**3,774,848**

Source: U.S. Census (2010).

3.13 Soils

3.13.1 Overview

The analysis area for soils consists of areas in the Project Area where soils would be directly impacted by construction and operation of the SSEP. Soils in the Project Area are generally deep and well drained to excessively drained (Johnson 1997). Furthermore, the soils range from sandy-skeletal to loamy-skeletal with extensive pebble cover at the land surface. Nearly all of these soils exhibit some level of illuviated carbonate, which is common in soils that develop in arid environments (Birkeland 1999). Some soils in the Project Area are susceptible to moderately high levels of wind erosion; others are susceptible to levels of water erosion ranging from slight to moderate.

Six soil complexes have been identified in the Project Area (Table 3.46). Of these six, three dominate the Project Area: 1) Denure-Rillito-Why, 2) Dateland-Cuerda, and 3) Gunsight-Rillito-Carrizo (Map 19). Denure-Rillito-Why Complex is the most dominant soil complex in the Project Area (Kirby 2009a). It is generally present on fan terraces with low slope angles. Gunsight-Rillito-Why Complex is restricted to fan terraces of very low slope angles, and is present mostly along the eastern edge of Project Area. Dateland-Cuerda generally occurs on fan terraces with low slope angles and is present mostly in the central portion of the Project Area. The additional three soils complexes make up less than 1% of the soils that occur in the Project Area (Table 3.46).

Table 3.46 Summary of Soils

Map Unit	Description	Water Erosion Potential	Wind Erosion Potential	Acres Occurring in the Project Area
Dateland-Cuerda	0%–3% slopes on fan terraces and flood plains Dateland-60%, Cuerda-30% Well drained Medium runoff Moderate permeability Topsoil depth 0"–9"	Very slight to slight	Moderate to moderately high	770.8
Denure-Rillito-Why	1%–5% slopes on fan terraces dissected by flood plains Denure-40%, Rillito-25%, Why-15% Somewhat excessively drained Medium runoff Moderate (Denure/Why) to rapid (Rillito) permeability Topsoil depth 0"–2"	Slight	Slight (Denure/Rillito) to Moderately High (Why)	2,657.0

Table 3.46 Summary of Soils

Map Unit	Description	Water Erosion Potential	Wind Erosion Potential	Acres Occurring in the Project Area
Gunsight-Rillito-Carrizo	1%–15% slopes on fan terraces dissected by flood plains	Very slight (Carrizo) to moderate (Gunsight)	Slight	271.3
	Gunsight-45%, Rillito-35%, Carrizo-15%			
	Somewhat excessively drained			
	Slow (Carrizo) to medium (Gunsight/Rillito) runoff			
	Moderate (Gunsight) to rapid (Rillito/Carrizo) permeability			
	Topsoil depth 0"–2"			
Denure-Coolidge	0%–7% slopes on relict basin floors, stream terraces or fan terraces	Slight	Moderately high (Coolidge)	2.5
	(percentage in complex pending geographic information system [GIS] numbers)		Slight (Denure)	
	Well drained to somewhat excessively drained			
	Medium runoff			
	Moderate to moderately rapid permeability			
	Topsoil depth 0"–13"			
Gilman Fine Sandy Loam	<0.5% slopes	Moderate	None	0.4
	Well drained			
	Slow runoff			
	Medium permeability			
Torriofluvents	1%–5% slopes			0.4
		Total Acres		**3,702.4**

3.13.2 Prime and Unique Farmlands

There are no ongoing agricultural operations in the Project Area. However, agricultural activities are ongoing east of the Project Area in the main body of Rainbow Valley. The Dateland-Cuerda complex is considered prime farmland soils based on properties of the soil types, a favorable growing season, and moisture supply (from precipitation or irrigation) that allow these soils to produce large quantities of food or fiber (Johnson 1997). There are approximately 770.8 acres of Dateland-Cuerda in the Project Area.

3.14 Special Designations

3.14.1 Overview

Special designation areas that the BLM manages under the National Landscape Conservation System consist of national monuments, national conservation areas, wilderness areas, WSAs, wild and scenic rivers (WSR) and national scenic and historic trails (NSHTs). Special designation areas are managed to protect their unique values and uses. These areas typically require a more intensive management emphasis than is applied to surrounding public lands. There are no wilderness areas, WSAs, WSRs or NSHTs in the Project Area; however, the Sierra Estrella Wilderness and the Sonoran Desert National Monument (including the North Maricopa Mountains Wilderness) fall in the viewshed and soundscape of the Project Area. The area of analysis for special designations is not a defined polygon but rather any topographic point in the wilderness areas or monument where sights or sounds from the Project Area may be experienced by a visitor. Details about the area of analysis can be found in Chapter 4.

3.14.2 Laws, Ordinances, Regulations, and Standards

Wilderness areas are managed in accordance with the Wilderness Act of 1964 and FLPMA of 1976. This legislation directs the BLM to manage wilderness for the public's use and enjoyment in a manner that would leave these areas unimpaired for future use and enjoyment as wilderness by providing for protection of these areas and preservation of wilderness character (43 CFR § 6300). Wilderness areas are also managed in accordance with the congressional acts that designate the wilderness area, such as the Arizona Desert Wilderness Act of 1990 that designated the North Maricopa Mountains Wilderness and the Sierra Estrella Wilderness.

3.14.3 Wilderness Areas

The North Maricopa Mountains Wilderness encompasses 63,200 acres and is located approximately 3 miles south of the Project Area. The Sierra Estrella Wilderness encompasses 14,400 acres and is located 10 miles east of the Project Area. The objectives for managing the wilderness areas are to maintain or enhance the natural character; 2) provide a diversity of primitive recreational opportunities and a high degree of solitude; 3) maintain the present vegetation communities; and 4) provide habitat and water for a diversity of fauna (BLM 1995). Recreation objectives for these wilderness areas provide for primitive settings and experiences that do not include OHV use (BLM 2005a). The recreation setting is characterized by an unmodified natural environment greater than 5,000 acres where a high degree of challenge and risk are present. Recreational activities include hiking, backpacking, back-country hunting, horseback riding, camping, wildlife observation, and photography (BLM 1995).

3.14.4 National Monuments

The Antiquities Act of 1906 grants the President authority to designate national monuments to protect objects of historic or scientific interest. The Sonoran Desert National Monument was established by Presidential Proclamation 7397 in 2001. The proclamation provides management for an "array of biological, scientific, and historic resources." A monument management plan is being prepared to establish management goals, objectives, and actions to accomplish the intent of the proclamation.

The Sonoran Desert National Monument encompasses 487,000 acres and is located approximately 1 mile south of the Project Area. It is managed by the BLM LSFO. According to the proclamation, the monument's biological resources are spectacular and diverse. Saguaros (*Carnegiea gigantea*), cholla (*Cylindropuntia* spp.), and the endangered acuna pineapple cactus (*Echinomastus erectocentrus* var. *acunensis*) are just a few of the plant species found in the monument. The monument is also home to the desert tortoise and many significant archaeological and historic sites, and it is managed to protect these resources. Recreational opportunities in the monument are undeveloped and visitor activities include camping, hiking, biking, and four-wheel driving.

3.15 Transportation and Traffic

3.15.1 Overview

The SSEP would be constructed and operated on currently undeveloped BLM land near the west end of Rainbow Valley. The main access to the SSEP would be located on the west end of the Project Area, approximately 5 miles east of the intersection of SR-85/Riggs Road. It is anticipated that the SSEP would entail construction of a two-lane paved roadway between the main gate and the intersection of SR-85 northbound ramps/Riggs Road, where it would form the new east leg of the intersection (see Map 14).

Because of the layout of the existing roadway network in the Project Area, most traffic to and from the SSEP is expected to pass through the intersection of SR-85/Riggs Road. The secondary access road along the Riggs Road alignment is meant to provide an alternative access (Smigelski 2009). The secondary access via Riggs Road would have only limited use for well field maintenance and would have limited operational employee access. The secondary road would not be used for construction access.

The Riggs Road extension between the SSEP main gate and the intersection of SR-85 northbound ramps/Riggs Road would form a new four-way intersection. Whereas the existing T-intersection at SR-85 northbound ramps/Riggs Road is controlled by a stop sign on the eastbound approach, the addition of the east leg and associated construction traffic would necessitate relocating the stop control to the northbound and southbound approaches. In turn, this would allow eastbound and westbound traffic on Riggs Road, east of SR-85, to be free flowing. In addition, the pavement marking for the eastbound approach would require modification to allow for an exclusive through-lane and an exclusive right-turn lane.

Based on construction and operational considerations described above, the area of analysis for transportation and traffic includes the Project Area (footprint) and extends to the access routes that are anticipated to be used for SSEP construction and operation, including SR-85/Riggs Road and Riggs Road. These intersections would constitute the primary and secondary access to the site, respectively.

3.15.2 Laws, Ordinances, Regulations, and Standards

The *ADOT Traffic Engineering Policies, Guides, and Procedures Section 240, Traffic Impact Analyses* stipulate that a traffic impacts analysis (TIA) be conducted for all new developments and for additions to existing developments that generate 100 or more trips during any one hour of the day.

A TIA was completed for the Project Area. Because of the expected high levels of traffic during the peak construction of the SSEP, a modified Category IIa TIA was completed and includes the peak construction year of the SSEP (assumed to be 2012) and the opening year (2014) of the SSEP. The results of this analysis are discussed in Chapter 4, Environmental Consequences in Section 4.15 (Transportation and Traffic).

3.15.3 Existing Conditions

SR-85 is an ADOT-administered, four-lane, rural, median-divided highway located approximately 5 miles west of the Project Area. The portion of SR-85 directly west of the Project Area was upgraded in 2005 from a two-lane highway to its current condition. Although portions of the road heading south toward Gila Bend have not been upgraded from Interstate (I)-10 south to the Riggs Road intersection, SR-85 is a median-divided, four-lane highway (ADOT 2005). It provides north-south access in the area and serves as a truck bypass route around Phoenix, Arizona, by way of links to I-8 and I-10. SR-85 also serves a

connection route for travelers between the greater Phoenix area and San Diego, California; it also connects Puerto Peñasco, Mexico, with the Town of Gila Bend, Arizona. In addition, SR-85 offers direct access to the Robbins Butte Wildlife and Buckeye Hills Recreation areas and the Arizona State Prison Complex. The posted speed limit on SR-85 is 65 mph. The road itself consists of two lanes in each direction and has wide shoulders; it does not have any curb, gutter, or sidewalk facilities.

Primary transportation corridors (local two-lane roadways) in the eastern portion of the area of analysis consist of Rainbow Valley and Riggs roads. Although there are improved and unimproved roads following some section and half-section lines for access to dispersed agriculture and residential areas throughout the area of analysis, transportation corridors in the area are sparse. The Komatke Road alignment and Haul Road are unimproved roadways used as access to existing utility facilities (i.e., switchyard) and the Wesco Mining Facility. Several unimproved roads provide access from the Komatke Road alignment to the Sonoran Desert National Monument. Primitive roads are located along the BLM-designated utility corridors. In the area of analysis, the BLM *Approved Amendment Lower Gila North Management Framework Plan and the Lower Gila South RMP and Decision Record* designates the area as "limited." OHVs and special recreation vehicles are limited to existing roads and vehicle routes. No cross-country vehicle travel is permitted (BLM 2005a). Several primitive roads, totaling 13.1 miles, cross the Project Area (see Map 14). These roads are available for public use. One private airstrip is located in the northeast portion of the area of analysis.

Data for 2008 daily traffic volumes on roadways that provide access to the Project Area were acquired from ADOT and the Maricopa County Department of Transportation (MCDOT). This 2008 data represent the most current available data. According to ADOT (2008), SR-85 currently accommodates an average annual daily traffic volume of approximately 11,370 vehicles from Land Fill Entrance Road to Buckeye Road. According to MCDOT, Rainbow Valley Road, at the intersection of Queen Creek Road, currently accommodates an average daily traffic count of 399 vehicles (MCDOT 2008). Riggs Road contains a Maricopa County ROW that crosses private and BLM land in a portion of the area of analysis south of the Project Area. The Maricopa County ROW is 65 feet wide and 8.25 miles long. No traffic counts have been conducted for Riggs Road.

Until recently, Riggs Road was a small dirt road located approximately 2 miles north of Patterson Road near milepost 141; it served the APS Jojoba Switchyard and Wesco Minerals Rainbow Valley Plant. With the construction of the Southwest Regional Landfill, a new paved intersection was completed at the Riggs Road alignment. The new intersection was constructed at the future location of a grade-separated traffic interchange that would be constructed as the SR-85 facilities are developed. There are no plans or funding in place in the 2011–2014 ADOT *State Transportation Implementation Program* (ADOT 2011) for a traffic interchange at SR-85 and Riggs Road. As part of the interim operation of the intersection, the final on-ramp/off-ramp locations of the future traffic interchange were constructed approximately 750 feet east and west of the SR-85 alignment, and Riggs Road was widened and paved to a four-lane roadway with a wide median. Located in this median, there would be a two-way, center lane between the future on-ramp/off-ramp locations. The median crossing of Riggs Road between the northbound and southbound lanes of SR-85 extends for approximately 100 feet. There is no posted speed limit on Riggs Road.

The SR-85/Riggs Road junction currently consists of four intersections. The first two are unsignalized intersections that are located at the existing alignments of northbound/southbound SR-85 (SR-85 northbound mainline/Riggs Road and SR-85 southbound mainline/Riggs Road). The eastbound and westbound approaches of Riggs Road to SR-85 provide a through lane and shared through/right-turn lane and are controlled by stop signs at SR-85. To turn left onto SR-85 from each approach, a vehicle must 1) enter the median where exclusive, "back-to-back," left-turn lanes are provided; 2) stop and wait for an acceptable gap in SR-85 traffic; and 3) complete the left turn. With approximately 100 feet of median space available, these left-turn lanes are relatively short, providing storage capacity for only two vehicles

at a time. The northbound approach to this intersection provides an exclusive left-turn lane, two through lanes, and an exclusive right-turn lane. Both the northbound left- and right-turn lanes provide approximately 680 feet of storage capacity. The southbound approach to this intersection offers an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. The southbound left-turn lane extends to Rainbow Valley Wash north of the intersection and provides approximately 800 feet of storage capacity.

The third intersection of SR-85/Riggs Road (SR-85 northbound ramps/Riggs Road) is located approximately 750 feet east of the northbound lanes of SR-85. This unsignalized "T" is controlled by a stop sign on the eastbound approach. The south leg of the intersection serves the Southwest Regional Landfill, and the north leg ends less than 100 feet north of the intersection, where several end-of-roadway barriers exist. Located right before the barriers, the Wesco Minerals Rainbow Valley Plant dirt access road begins and travels to the east. The Southwest Regional Landfill road is posted at 45 mph. The northbound approach to the T-intersection provides for a shared left-turn/through lane, and the southbound approach offers a shared through/right-turn lane. The eastbound approach has an exclusive left-turn and an exclusive right-turn lane.

The final intersection of SR-85/Riggs Road is located approximately 750 feet west of the southbound alignment of SR-85, where the paved section of Riggs Road ends. This is the location of the future southbound on-ramps and off-ramps of the traffic interchange. Currently, a narrow dirt access road extends to the south to provide access to the Desierto Verde area. Figure 3.7 shows existing lane configurations and traffic controls.

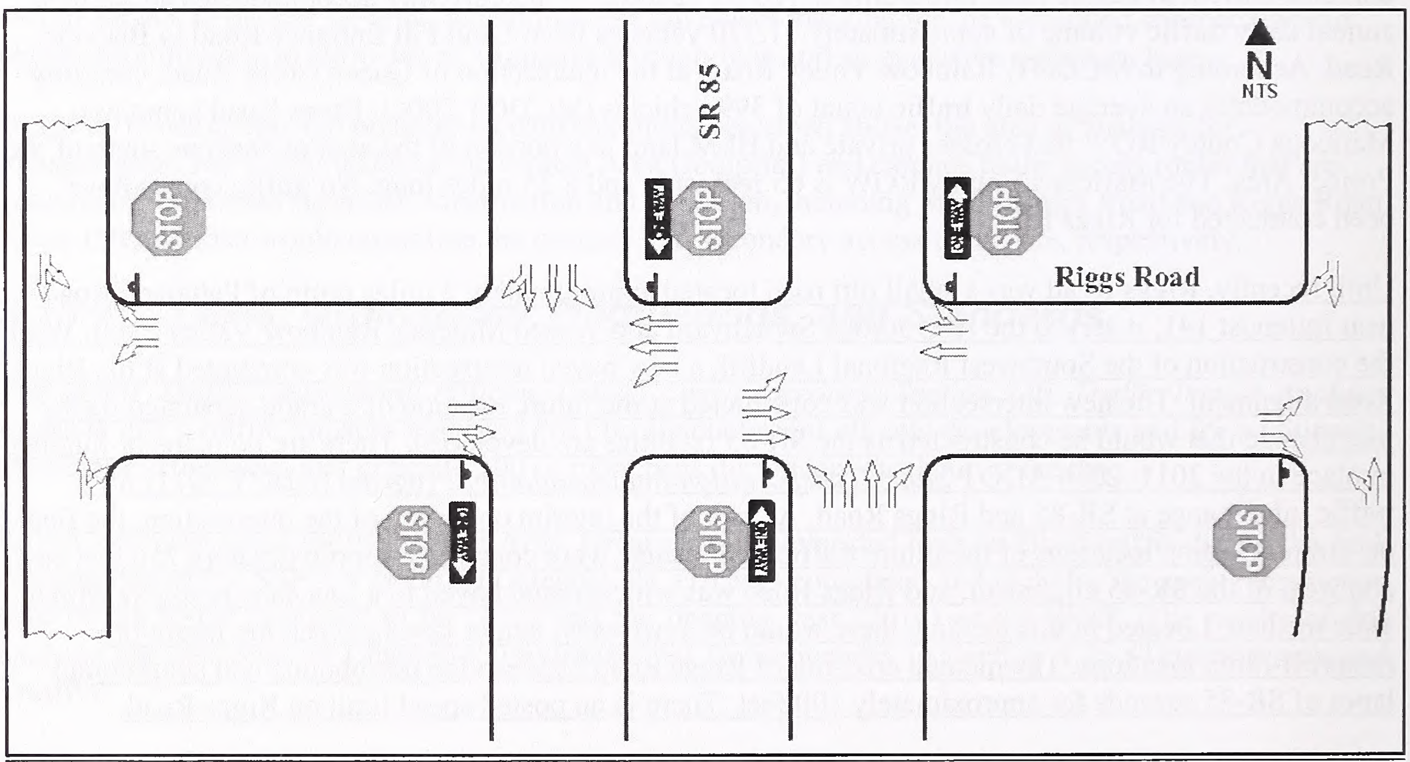

Figure 3.7 Existing lane configurations and traffic control.

3.15.3.1 EXISTING TRAFFIC DATA

To form a basis for analysis of the traffic related impacts of the SSEP, weekday AM and PM peak hour turning movement counts were conducted at the intersection of SR-85/Riggs Road at the mainline of SR-85.

The weekday turning movement counts were conducted from 7:00 to 9:00 AM and from 4:00 to 6:00 PM. The traffic counts were conducted in November 2009.

The existing weekday AM and PM peak hour traffic volumes are shown in Figure 3.8. The traffic counts show the traffic on Riggs Road to be very low volume and uncongested. Traffic on SR-85 would be considered moderate to low.

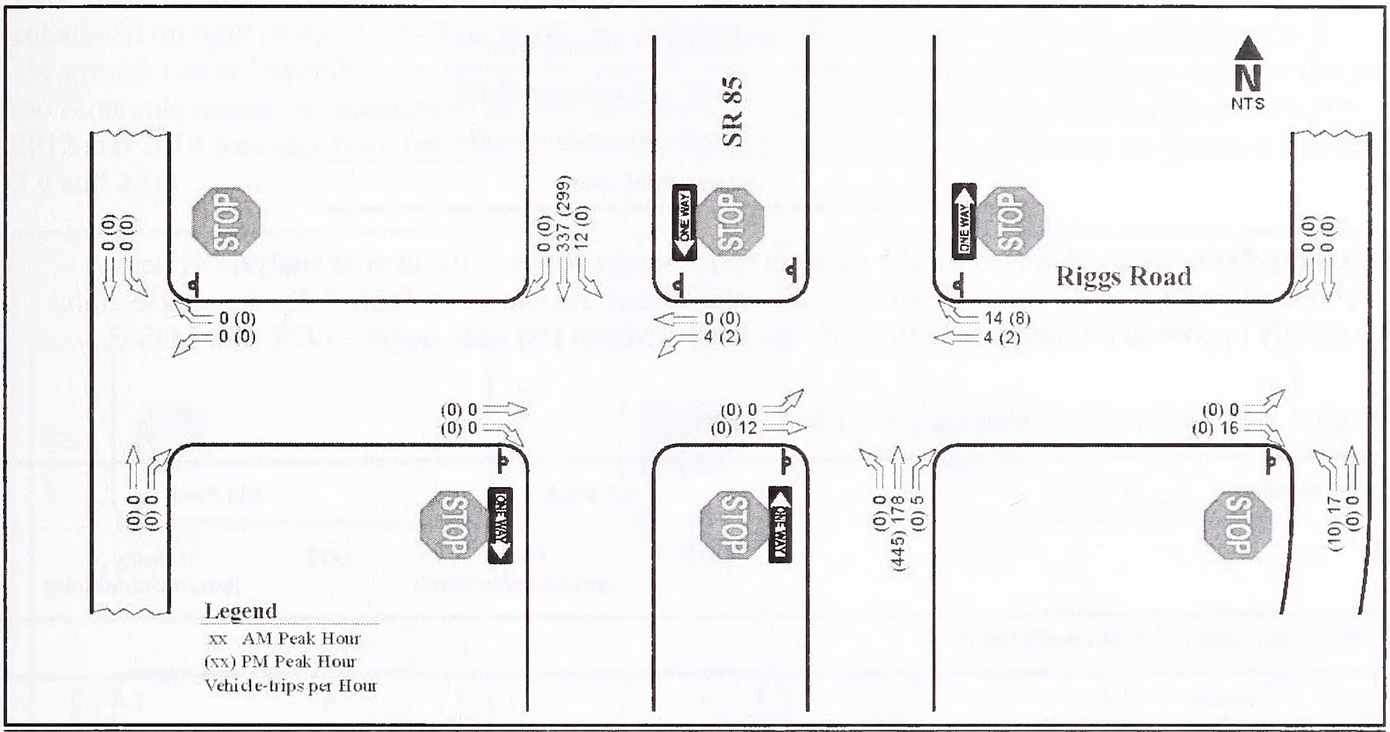

Figure 3.8 Existing weekday peak hour traffic volumes.

3.15.3.2 EXISTING TRAFFIC OPERATIONS

Analysis of current intersection operations was conducted for the weekday AM and PM peak hours using the nationally accepted methodology set forth in the Highway Capacity Manual (Transportation Research Board 2004). The computer software Highway Capacity Software was used to calculate the levels of service for individual movements, approaches, and the intersections as a whole.

Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. LOS is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS C or better is typically considered adequate operation (limited to no congestion) at signalized and unsignalized intersections in rural areas.

At unsignalized intersections, LOS is calculated for those movements that must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. Table 3.47 gives the criteria for LOS at unsignalized intersections.

Table 3.47 LOS Criteria at Unsignalized Intersections

LOS	Delay
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle
F	> 50 seconds/vehicle

Existing LOSs were calculated for the adjacent SSEP intersections in the area of analysis. A heavy vehicle percentage of 25% was assumed in the calculations. As shown in Table 3.48, the intersections currently operate at an adequate LOS in the weekday AM and PM peak hours—LOS A or LOS B.

Table 3.48 Existing Peak Hour Levels of Service

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds/vehicle)	LOS	Delay (seconds/vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.4	A	7.4
Eastbound through	B	11.7	B	11.1
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.2	A	9.8
Westbound through	B	11.7	B	11.1
Westbound approach	B	10.2	A	9.8
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.2	A	10.2
Eastbound through	B	10.7	B	12.5
Eastbound approach	B	10.7	B	12.5
Westbound through	B	10.6	B	13.1
Westbound through/right	A	9.3	B	10.3
Westbound approach	A	9.4	B	10.5
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.6
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.6

3.15.4 Future Traffic Operations without SSEP

To assess the impacts of the SSEP on future traffic operations, traffic projections were made for 2012 and 2015. Year 2012 represents the assumed peak construction year, whereas 2015 is the expected build-out year.

Because of the lack of detailed historic traffic data in the analysis area, a growth rate could not be calculated. In light of this, a 3% growth rate was used to estimate traffic growth in the analysis area. A 3% growth rate is lower than the normal 5% growth rate historically used in traffic growth analysis due to the economic recession experienced in 2008 and 2009. Using the compounded yearly traffic growth rate, 2012 and 2014 weekday peak hour traffic volumes without the SSEP were estimated, as shown in Figures 3.9 and 3.10.

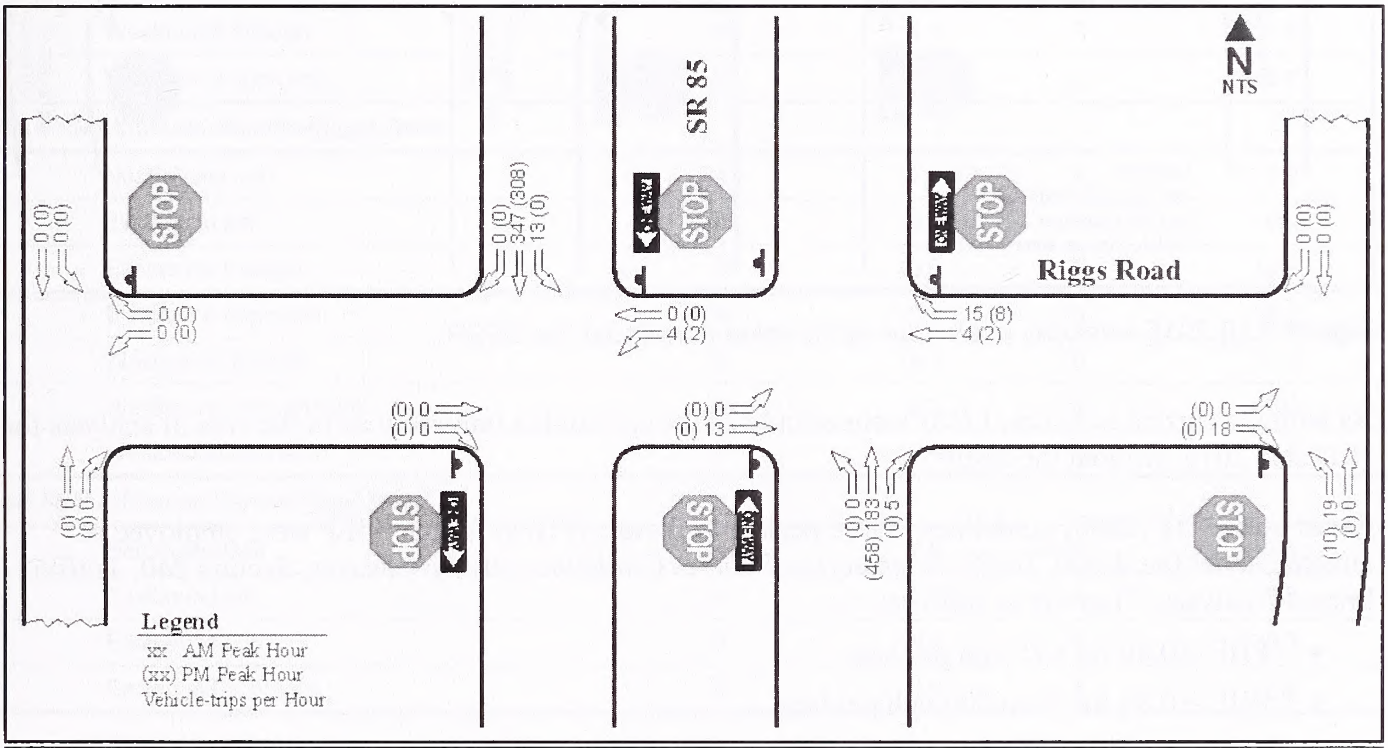

Figure 3.9 2012 Weekday peak hour traffic volumes without the SSEP.

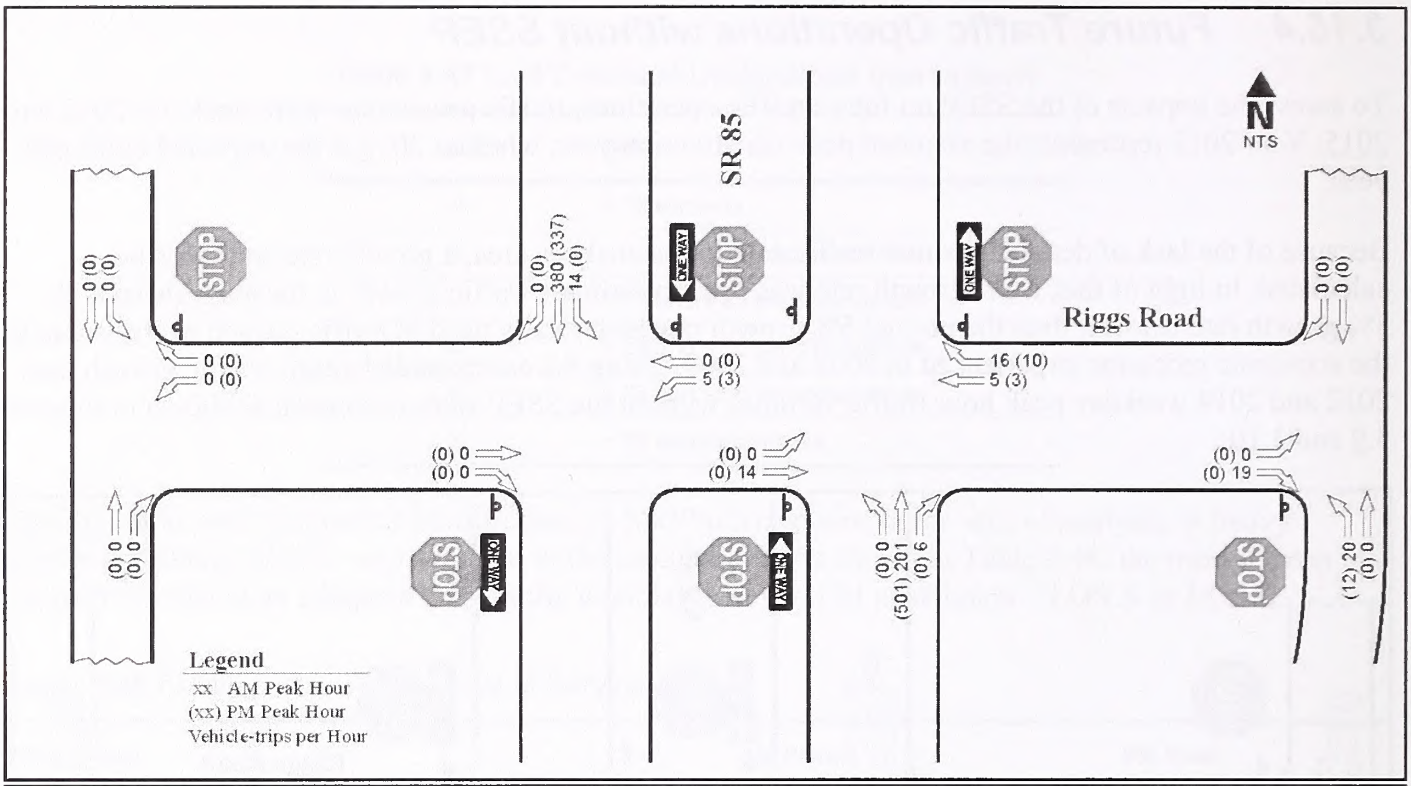

Figure 3.10 2015 weekday peak hour traffic volumes without the SSEP.

As with the current volumes, LOSs were calculated for each of the intersections in the area of analysis for 2012 and 2015, without the SSEP.

Based on ADOT (2000) guidelines, future peak hour factors (PHFs) for the SSEP were employed as directed under the *ADOT Traffic Engineering Policies Guidelines and Procedures*, Section 240, Traffic Impact Analyses. They are as follows:

- PHF = 0.80 for <75 vph per lane
- PHF = 0.85 for 75 to 300 vph per lane
- PHF = 0.90 for >300 vph per lane

As shown in Tables 3.49 and 3.50, the Project Area intersections are predicted to continue operating at an adequate LOS B or better in 2012 and 2015, without traffic from the SSEP.

Table 3.49 2012 Peak Hour Levels of Service without SSEP

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.5	A	7.4
Eastbound through	B	11.9	B	11.2
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9
Westbound through	B	11.9	B	11.2
Westbound approach	B	10.3	A	9.9
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2
Eastbound through	B	10.8	B	12.6
Eastbound approach	B	10.8	A	10.2
Westbound through	B	10.6	B	13.3
Westbound through/right	A	9.3	B	10.3
Westbound approach	A	9.4	B	10.6
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.6
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.6

Table 3.50 2015 Peak Hour Levels of Service without SSEP

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.5	A	7.4
Eastbound through	B	12.2	B	11.3
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.5	A	10.0
Westbound through	B	12.2	B	11.4
Westbound approach	B	10.5	A	10.0
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.4
Eastbound through	B	11.0	B	13.1
Eastbound approach	B	11.0	A	0.0
Westbound through	B	10.8	B	13.8
Westbound through/right	A	9.5	B	10.5
Westbound approach	A	9.6	B	10.7
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.7
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.7

3.16 Vegetation and Special-status Plant Species

This section describes the dominant vegetation communities and special-status plant species, including federally protected and state-protected species, and invasive and noxious weed species.

3.16.1 Overview

The Sonoran Desert ecoregion extends from southeastern California across the western two-thirds of southern Arizona and south into Baja California and Sonora, Mexico (MacMahon 2000). The Sonoran Desert has the highest diversity of plant growth forms of any desert in the world, and is the most biologically diverse of North American deserts (MacMahon 2000). The Sonoran Desertscrub Biome, as described by Turner and Brown (1994), is subdivided into six major subdivisions based on climate and species composition. The Project Area and surrounding vegetation are located entirely in the Lower Colorado River Valley Subdivision, which is the largest and driest subdivision of the Sonoran Desert (MacMahon 2000). This subdivision is dominated by burrobush (*Ambrosia dumosa*) and creosotebush (*Larrea tridentata*) and has comparatively low species diversity and structural complexity compared to other subdivisions of the Sonoran Desert (MacMahon 2000).

Vegetation resources in and adjacent to the Project Area provide cover, browse, nesting, and brooding habitats for a variety of wildlife species (see Section 3.19). Sonoran Desert vegetation also functions as a dynamic interface between the soil and atmosphere, where it intercepts precipitation, captures overland water flow, retains and transports soil, water, and nutrients in plant roots, and transports water and nutrients back to the atmosphere through loss of water vapor from leaves and stems.

Biological field reconnaissance surveys in 2008 and 2009 were conducted in the Project Area and within an approximately 2-mile buffer around the Project Area (Pape 2009). The surveys encompassed all ecologically similar portions of the Little Rainbow Valley to the pediment at the base of the Buckeye Hills and North Maricopa Mountains. Because surveys were conducted for the 2-mile buffer surrounding the Project Area (as well as in the Project Area), we assume that the plant species identified in the survey area occur in the Project Area. The analysis area for vegetation communities and special-status plant species is limited to the Project Area, because surface-disturbing activities that would remove vegetation are limited to the Project Area. The analysis area for invasive and noxious plant species consists of the perimeter of the Project Area, including linear facilities and transportation corridors. This perimeter represents the interface between long-term and temporary surface disturbances and native vegetation communities, which is where noxious and invasive plant species would be most likely to become established and spread into adjacent habitats.

3.16.2 Laws, Ordinances, Regulations, and Standards

Ground-disturbing activities or placement of structures may impact special-status plant species or their habitats. As such, laws have been developed for their protection; and where applicable, they are considered during SSEP resource reviews. The following laws are applicable to vegetation resources in the Project Area.

3.16.2.1 ENDANGERED SPECIES ACT SECTION 7 (16 U.S.C. § 1531, AND 50 CFR § 17.1)

The ESA was passed by the United States Congress in 1973. The ESA directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. Section 7 of the ESA is the mechanism by which federal agencies ensure the actions they take,

including those they fund or authorize, do not jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat of any listed species.

Only species listed by the USFWS are afforded protection under the ESA. The BLM has initiated informal consultation with the USFWS for the SSEP. A biological assessment (BA) has been prepared for the SSEP to determine if there would be any project-related impacts to any federally listed species and/or their designated critical habitat. The BA has been submitted to the USFWS, who has concurred with a "no effect" determination to any listed species. No federally listed plant species are known to occur in the Project Area or in the approximately 2-mile buffer surrounding the Project Area.

3.16.2.2 BLM SENSITIVE SPECIES REGULATIONS

BLM Manual Section 6840 is a federal guidance document that outlines the criteria for listing species as sensitive on BLM-administered lands and provides direction on management of those species. BLM sensitive species are species that the USFWS currently has under status review; species whose populations are declining rapidly and may warrant federal protection in the future; species that have small, widely distributed populations; and species that are located in special or unique habitats. Additionally, IM No. AZ-2006-002, Change 1, dated September 30, 2006, provides a current updated list of the species designated as sensitive by the BLM in Arizona. In compliance with BLM Manual Section 6840, the BLM sensitive species list (BLM 2005c) for the LSFO was consulted to evaluate the potential for sensitive plant species to occur in the Project Area (see Section 3.16.4).

3.16.2.3 ARIZONA NATIVE PLANT LAW

The ADA oversees native plant resources in the State of Arizona, and impacts to native plants are regulated under applicable State of Arizona Revised Statutes and Administrative Codes (A.A.C. Article 11: Arizona Native Plants; R3-3-1101 through R3-3-1111; and A.R.S. §§ 3-901 through 3-916) (ADA 2009a). These laws state that protected plants cannot be removed from any lands, including private lands, without permission and a permit from the ADA. Proponents of projects that would impact 40 acres or more must notify the ADA 60 days prior to removal of plants. Landowners may sell or give away native plants on their land, but plants may not be legally possessed, taken, or transported from the growing site without a permit from the ADA. The ADA classifies protected native plant species into four categories: 1) highly safeguarded, 2) salvage restricted, 3) salvage assessed, and 4) harvest restricted.

Plants in the highly safeguarded category are those species that are in danger of extinction or whose prospects for survival in Arizona are in jeopardy. No collection is allowed for highly safeguarded plant species; however, salvage may be allowed for conservation or scientific purposes. Salvage restricted plant species are those that are subject to damage by theft or vandalism, and include most native Arizona cacti species and other specimen plants such as ocotillo (*Fouquieria splendens*). Salvage assessed plant species are those species that have sufficient value if salvaged, such as common desert trees. Harvest restricted plant species are those that tend to be subject to locally excessive harvesting or overcutting because of their intrinsic value, but may not be considered threatened range wide. All plant species identified during reconnaissance surveys are listed in the final technical report (Pape 2009). All native plants in the Project Area would be managed according to ADA protocols (see Section 3.16.4, below).

3.16.2.4 INVASIVE AND NOXIOUS PLANT SPECIES REGULATIONS

Federal agencies are required by EO 13112, Invasive Species, to consider which agency actions may affect the status of invasive species and shall, to the extent practicable and permitted by law, do the following:

- Identify such actions.
- Subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.
- Not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

The Plant Protection Act of 2000 (P.L. 106-224) replaced the Federal Noxious Weed Act of 1975 (P.L. 93-629) and is administered by the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA). This federal program was enacted to protect the health and value of American agriculture and natural resources, and authorizes APHIS to take both emergency and extraordinary emergency actions to address incursions of noxious weeds.

State of Arizona Regulated, Restricted, and Prohibited Noxious Weeds regulations (A.A.C. §§ R3-4-244 and R3-4-245) address the control and eradication of noxious weeds and identifies specific species that fall under three noxious weed categories: regulated, restricted, and prohibited. The Plant Services division of the ADA is responsible for implementing these noxious weed regulations. Definitions of these three weed classes are as follows: 1) regulated noxious weeds are exotic plant species that are well established and generally distributed throughout Arizona; 2) restricted noxious weeds are exotic plant species that occur in Arizona in isolated infestations or very low populations; and 3) prohibited noxious weeds are exotic plant species with known qualities that do not currently exist in Arizona.

3.16.2.5 ARIZONA DEPARTMENT OF TRANSPORTATION GUIDELINES

The ADOT guidelines for highways on BLM and U.S. Forest Service Lands (ADOT et al. 2008) manual provides specific guidance for the design, construction, maintenance, and landscape restoration for road development on lands managed by BLM and the USFS.

3.16.3 Vegetation Communities

As previously stated, vegetation in the Project Area is typical of the Lower Colorado River Valley Subdivision of the Sonoran Desertscrub Biome, as defined by Brown (1994). The surrounding desert mountains (outside of the Project Area) are in the Arizona Upland subdivision of the Sonoran Desert and are dominated by the Sonoran Palo Verde-Mixed Cacti vegetation community. The entire Project Area is in the Sonoran Creosotebush-Bursage Scrub series, which is most typical of the Lower Colorado River

Valley Subdivision vegetation community. Most of the Project Area is dominated by creosotebush, which occurs as pure stands or in association with microphyllous (small-leaved) legume tree species such as yellow palo verde (*Parkinsonia microphylla*) and desert ironwood (*Olneya tesota*) along xeroriparian washes[3].

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. The Xeroriparian Wash community (as described in Section 3.16.3.2, below) contains generally the same plant species as the surrounding Sonoran Creosotebush-Bursage Scrub community, but plants occur at higher densities due to ephemeral water availability in the washes. For this reason, the entire Project Area comprises the Sonoran Creosotebush-Bursage Scrub with increased density of vegetation in the wash areas. The Xeroriparian Wash community is treated as a distinct vegetation community because higher densities of plants would be affected by proposed activities in the linear washes than in upland Sonoran Creosotebush-Bursage Scrub. Table 3.51 provides the acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash in the Project Area. Map 20 shows the distribution of vegetation communities in the Project Area. Individual cactus numbers and overall species diversity are low, except in and adjacent to the northwestern portion of the Project Area, where saguaros and chollas occur in moderate density. Saguaros are few and widespread in the Project Area.

Table 3.51 Vegetation Community Acreages/Linear Feet in the Project Area

Vegetation Community	Acres/Linear Feet
Sonoran Creosotebush-Bursage Scrub	3,702.4 acres
Xeroriparian Wash	39,552.5 feet

In addition to the two vegetation communities listed in Table 3.51, which both occur in and adjacent to the Project Area, the Sonoran Palo Verde-Mixed Cacti/Sonoran Creosotebush-Bursage vegetation community type occurs north and south of the Project Area. Vegetation north and south of the Project Area typically includes a few creosotebushes with an occasional cholla cactus, saguaro, or ocotillo, and small to moderate numbers of devil's spineflower (*Chorizanthe rigida*) and/or sandmat (*Chamaesyce* sp.). Areas of desert pavement, which support almost no plant species, are common approximately 2 miles north of the Project Area.

Biological soil crusts (BSCs) consist of blue and green algae, lichens, mosses, fungi, and bacteria that bind the surface of the soil (Belnap et al. 2001). These soil crusts are a major component of vegetation communities in the Sonoran Desert, and are recognized as important features of desert ecosystems due to their ability to stabilize the soil, capture and retain atmospheric moisture and rainfall, facilitate seed germination, and increase nutrient availability for plant growth (Belnap et al. 2001). There is reasonable expectation that BSCs occur in the Project Area, either intact or as remnants due to historic soil disturbances.

3.16.3.1 SONORAN CREOSOTEBUSH-BURSAGE SCRUB

The dominant vegetation community in the Project Area is Sonoran Creosotebush-Bursage Scrub. This vegetation community occupies approximately 3,620 acres (100%) of the Project Area and is dominated by creosotebush, which occurs in pure stands over relatively large portions of the Project Area. Triangle

[3] Xeroriparian washes are ephemeral washes that serve as dispersal corridors for plants and animals.

bur ragweed (*Ambrosia deltoidea*) and/or burrobush are commonly co-dominant with creosotebush in the Lower Colorado River Valley Subdivision, but do not occur at high enough densities to be considered co-dominants in the Project Area.

3.16.3.2 XERORIPARIAN WASH

The Xeroriparian Wash vegetation community is typically associated with an ephemeral water supply and contains a similar species composition as surrounding upland areas, but at higher densities. This vegetation community comprises approximately 39,500 linear feet of ephemeral washes in the Project Area. Xeroriparian Wash is dominated by desert ironwood and palo verde (*Parkinsonia* spp.). This community also contains several shrub species, including wolfberry (*Lycium* spp.), catclaw acacia (*Acacia greggii*), and white ratany (*Krameria grayi*).

The technical report (Pape 2009) contains a list of all plant species observed in the Project Area.

3.16.4 Special-status Species

One BLM sensitive plant species and 12 plant species that are protected under Arizona Native Plant Law are known to occur in the Project Area. No federally listed, candidate, or proposed plant species were identified during field reconnaissance surveys. Further, none are likely to occur in the Project Area or surrounding vegetation communities because there is no suitable habitat for the species in the Project Area and/or the Project Area is outside of the known range of the species (Pape 2009). There are no designated critical habitats for any federally listed plant species in the Project Area or surrounding vegetation communities. There are no federal plant species of concern or ADA highly safeguarded plant species known or likely to occur in the Project Area or surrounding vegetation communities. The final technical report (Pape 2009) lists the federal, BLM sensitive, and ADA highly safeguarded plant species that were reviewed for potential to occur in the Project Area.

3.16.4.1 ARIZONA NATIVE PLANT LAW PROTECTED SPECIES

The saguaro cactus is protected under Arizona Native Plant Law (ADA 2009a). The species occupies desert slopes and well-drained flats, especially rocky bajadas (Epple and Epple 1995) in the Sonoran Desert. The species' range is limited to below 4,000 feet in elevation and to areas with above-freezing temperatures in the winter. Saguaro may be found growing above 4,000 feet on south-facing slopes. Under the Arizona Native Plant Law, saguaros are protected as salvage restricted, which requires a permit for any impacts to the species. Any crested saguaros (saguaro cacti with a fan-shaped top) found in the Project Area would be considered highly safeguarded under the Arizona Native Plant Law. Saguaro cacti are few and widespread in the approximately 3,620-acre Project Area. No crested saguaro cacti are known to occur in the Project Area or surrounding vegetation communities. Table 3.52 identifies other ADA-protected plant species that are also known to occur in the Project Area.

Table 3.52 Arizona Native Plant Law Protected Species Known to Occur in the Project Area

Scientific Name	Common Name	ADA Status[†]
Carnegiea gigantean	Saguaro	Salvage Restricted
Castela emoryi	Crucifixion thorn	Salvage Restricted
Cylindropuntia bigelovii	Teddybear cholla	Salvage Restricted
Echinocereus engelmannii	Engelmann's hedgehog cactus	Salvage Restricted
Ferocactus wislizeni	Candy barrelcactus	Salvage Restricted
Fouquieria splendens	Ocotillo	Salvage Restricted
Hesperocallis undulata	Desert lily	Salvage Restricted
Mammillaria grahamii	Graham's nipple cactus	Salvage Restricted
Olneya tesota	Desert ironwood	Salvage Assessed; Harvest Restricted
Parkinsonia florida	Blue palo verde	Salvage Assessed
Parkinsonia microphylla	Yellow palo verde	Salvage Assessed
Prosopis glandulosa	Honey mesquite	Harvest Restricted; Salvage Assessed
Prosopis velutina	Velvet mesquite	Harvest Restricted; Salvage Assessed

[†] Salvage Restricted = collection or destruction by permit only; Salvage Assessed = plants have significant value if salvaged; and Harvest Restricted = permit required to remove plant/plant by-products (fuel wood).

3.16.5 Invasive and Noxious Plant Species

Federal regulations (including the EO on Invasive Species and the Plant Protection Act) and state regulations (including the ADA regulations on noxious weeds) require that the BLM address proposed actions on their lands throughout the LSFO in regard to noxious weeds and their potential effects (Harper-Lore 2007). Even though most of the non-native plant species addressed here were not observed in the Project Area, these species are known to exist in the region; thus, the activities proposed under the action alternatives could allow the introduction of these species through soil disturbances.

The invasion and establishment of non-native plant species are a threat to the overall health of the Sonoran Desert ecosystem. Not only do these species outcompete the native flora for resources, but also the presence of these invasive, non-native plants increases the fuel load for wildfires. The flora present in the Sonoran Desert did not evolve with these non-native plants; thus, competition for resources, such as soil, water, and nutrients, is severe, and often the non-natives replace the natives throughout the landscape. In addition, invasive plant species increase fine-fuel loads, which increases the areal extent of fires and fire frequencies (Arizona Wildlands Invasive Plants Working Group [AZ-WIPWG] 2005).

Two invasive plant species were observed in the Project Area during reconnaissance surveys: Saharan mustard (*Brassica tournefortii*) and redstem stork's bill (*Erodium cicutarium*). In addition, two invasive grass species, buffelgrass (*Pennisetum ciliare* [syn. *Cenchrus ciliaris*]) and red brome (*Bromus rubens*), and Mediterranean grass (*Schismus arabicus* and *S. barbatus*) are addressed here. Buffelgrass and red brome are not known to occur in or adjacent to the Project Area, but Mediterranean grass has been reported in the Project Area. All three grass species are aggressive invaders with widespread distributions in the Sonoran Desert. There is high potential for the introduction of these species into the Project Area or adjacent habitats through transportation corridors or other project-related infrastructure where vehicle use facilitates the movement of seeds or root fragments. Buffelgrass is currently distributed along nearby transportation corridors, including SR-85, SR-86 and I-10 (Arizona-Sonora Desert Museum [ASDM] 2010). All five invasive and noxious plant species addressed here possess growth and dispersal strategies

that give them a competitive advantage over native plant species, due to their rapid growth and ability to produce large amounts of seed (Sakai et al. 2001). In addition, some of these species produce toxic or inhibitory chemicals that alter surrounding soil conditions and inhibit the growth of native species. Because of the potential for invasive and noxious plant species to be moved into the area through roads and other vehicle routes, the analysis area for noxious and invasive plant species consists of the perimeter of the Project Area where noxious and invasive plant species are most likely to become established and spread into adjacent habitats.

3.16.5.1 SAHARAN MUSTARD

Saharan or Asian mustard is an introduced, annual forb species in the mustard family (Brassicaceae). The species is highly invasive and is cited as a "major management concern" for Maricopa County, Arizona (California Invasive Plant Council [Cal-IPC] 2005). Saharan mustard is ranked as a medium-level threat to Arizona wildlands due to its impacts to plant and animal communities, moderate to high rates of dispersal that are enhanced by disturbance, and broad ecological tolerance (AZ-WIPWG 2005). The species competes with native plant species and ultimately excludes native plants, thereby altering the composition and structure of vegetation communities (Cal-IPC 2005). Saharan mustard infestations alter the structure and composition of wildlife habitat by outcompeting native shrubs and forbs, reducing the availability and quality of forage, and by increasing the fuel load and associated fire potential. Dense stands of Saharan mustard promote the spread of fire across desert habitats in which the native plants and animals are not adapted to fire. Saharan mustard is also high in oxalic acid, which is potentially toxic to desert tortoise and other native herbivores (Cal-IPC 2005). Each mustard plant can produce large numbers of seeds, which are rapidly and widely dispersed through "tumbleweed" dispersal, in which portions of plants containing seed pods and seeds break off the plant and are moved by wind. The seeds' sticky coating allows them to be dispersed long distances by animals or vehicles (Cal-IPC 2005). Saharan mustard seeds are known to live three or more years in the soil, and soil disturbance can promote germination of seeds (Cal-IPC 2005).

Saharan mustard, like other annual weeds, is difficult to control due to its rapid spread, rapid growth and reproduction, long period of seed viability, and its ability to produce multiple seed crops in a single year (Cal-IPC 2005). Controls for Saharan mustard may be effective in controlling other weed species, including redstem stork's bill. However, control of Saharan mustard in particular should focus on stopping seed production. Seed germination can be promoted by supplemental watering followed by a pre-planned treatment with herbicide (Cal-IPC 2005). Hand pulling is effective if plants are removed before seed set and if ongoing monitoring and follow-up treatments are practiced. There are multiple effective herbicides for mustards (e.g., Telar, Escort, Plateau, Habitat, and Velpar) (Cal-IPC 2005). Other herbicides may also be effective. Spot application is the most effective, but broadcast, nonselective herbicides can be used in disturbed areas, roadsides, and other bareground areas. Grading with heavy equipment has been identified as a source of weed spread, with timing of disturbance prior to seed development essential for reducing spread of viable seed. Washing or decontamination of excavation and personal equipment before it is brought to the project site and before it is moved from the site prevents transport of seed (Cal-IPC 2005). Revegetation immediately following disturbance is also effective in reducing weed infestation. Monitoring of disturbed sites with follow-up treatments is necessary to limit the establishment or spread of Saharan mustard and other invasive species.

3.16.5.2 REDSTEM STORK'S BILL

Redstem stork's bill is an introduced, annual forb species in the geranium family (Geraniaceae). The species tolerates a very wide range of ecological conditions and is distributed throughout North America (Howard 1992). Redstem stork's bill is widespread in Arizona and occupies nearly all vegetation community types in the state (Newman 2001). The species flowers early and can produce seed throughout the growing season. The species is dispersed via hooked seeds that are easily moved long distances when they become attached to clothing, animal fur, or vehicles. The species has the potential to spread rapidly and can crowd out native plant

species where it occurs in high densities (Whitson et al. 1996). Redstem stork's bill is ranked as a medium-level threat to Arizona wildlands due to its impacts to plant and animal communities, moderate to high rates of dispersal that are enhanced by disturbance, and broad ecological tolerance (AZ-WIPWG 2005). Like the other weed species addressed here, dense, continuous stands of this species can contribute to fuel loading and increased fire frequency in areas not adapted to fire (Howard 1992). Redstem stork's bill does not currently occur at high densities anywhere in the Project Area. The species is used as forage by wildlife, including mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*) and desert tortoise, but its value as forage is negated by the exclusion of native plant species, alteration of vegetation community composition and structure, and reduced availability of forage species to which native wildlife are adapted (AZ-WIPWG 2005).

3.16.5.3 BUFFELGRASS

Buffelgrass is a highly drought tolerant, perennial in the grass family (Poaceae). The species is native to Africa, the Middle East, Indonesia and tropical Asia (ASDM 2010). It was introduced to the United States in the 1930s and its range has expanded rapidly since the 1980s (ASDM 2010). Buffelgrass is now common in southern Arizona and listed as a noxious weed by the State. It is also ranked as a high-level threat to Arizona wildlands due to its severe ecological impacts on plant and animal communities, alteration of vegetation structure, high rates of dispersal and establishment, and unusually broad distribution and ecological range (AZ-WIPWG 2005). The species' dense growth habit crowds out native plants and it can weaken and kill larger desert plants by competing aggressively for available water. Dense concentrations of buffelgrass can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire. A buffelgrass invasion may only persist for 10 to 15 years (AZ-WIPWG 2005), during which time it impoverishes the soil. The plant dies once the soil has been depleted of nutrients and leaves sterile soil that requires costly treatments to restore. Buffelgrass can be controlled by manual pulling and herbicides, which should be focused on roadside infestations outside of urban zones and other transportation corridors that facilitate transport of seed into native habitats.

3.16.5.4 MEDITERRANEAN GRASS

The Mediterranean grass species are annual grasses (family Poaceae) native to southern Europe, northern Africa, and the Near East. Like buffelgrass and red brome, this invasive grass contributes to the conversion of desert shrublands into annual grasslands, and forms dense stands that can increase fuel loads and fire frequency in desert vegetation communities (Cal-IPC 2010). Mediterranean grass invades areas disturbed by grazing, offroad-vehicle use, and construction (Cal-IPC 2010). The species are spread by seed dispersed by wind and floods and are not spread through horizontal runners or root fragments. Seeds germinate in open habitats in early spring and mature very quickly, with plants potentially flowering and producing seed in two weeks (Cal-IPC 2010). Mediterranean grass does not tolerate shading and usually occupies open areas between desert shrub cover (Cal-IPC 2010). Dense concentrations of Mediterranean grass species can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire.

3.16.5.5 RED BROME

Red brome is a cool season annual in the grass family (Poaceae) that germinates in the fall with a slow winter growth period and rapid growth and flowering in early spring (Newman 2001). Red brome occurs at elevations below 5,000 feet in deserts, chaparral, roadsides, waste places and other vegetation communities with low plant density and minimal competition (Newman 2001). The species is not able to compete with established plants due to its very shallow root system and inability to tolerate shade (Newman 2001). The awns and other floral structures of the plant can damage intestinal and other sensitive tissues of livestock and native fauna (Newman 2001). The species decays very slowly over up to two years, which results in the accumulation of dead stalks and can increase fire frequency and intensity (Newman 2001). Dense infestations of red brome can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire.

3.17 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of these elements there is in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resource values and uses and the scenic quality of the landscape. The BLM uses the Visual Resource Management (VRM) system to manage visual resources within its jurisdiction. The system uses four visual management classes:

- **Class I.** The objective is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and should not attract attention.
- **Class II.** The objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **Class III.** This objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV.** The objective is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic elements of the landscape. (BLM 1986).

Under the BLM's current plan, the Lower Gila South RMP, the Project Area and adjacent landscapes are designated as VRM Class IV (BLM 1985).

The SSEP's area of potential visual effects (hereafter referred to as the visual analysis area) includes lands where potential changes to the landscape from the SSEP may be visible to travelers, residents, and those working or recreating and sightseeing in the visual analysis area. The visual analysis area consists of the Project Area and a 15-mile buffer surrounding the Project Area (see Map 21). The 15-mile buffer used to define the visual analysis area was determined after consultation (Johnson 2011) with the BLM and is based on the BLM's definition of background distance zone: the BLM has defined 15 miles as the farthest background distance for visual resource inventories and for visual contrast analysis; these concepts are discussed below.

A viewshed analysis was conducted using geographical information system (GIS) data to assess where the SSEP would be visible within the landscape, and this analysis was verified in the field. The viewshed analysis is a computer-generated map that shows those areas within the surrounding landscape where the project structures and surface disturbances could be visible. The concept underlying the viewshed analysis is that the topography surrounding the Project Area would partially obscure or screen the project from

public view. By generating a computer map that shows where the project would be visible and would not be visible, it becomes possible to define the extent of the impacts and to select representative places where the effects of the project on scenic quality could be assessed. The results of the viewshed analysis were used to further refine the visual analysis area (see Maps 21 and 22). Using the results of the viewshed analysis, 19 KOPs were selected that represent typical viewing conditions of the SSEP (see Section 4.17 for a more detailed explanation of KOPs). The KOPs were located along major travel routes and access roads, in recreational areas, and near residences and communities within the visual analysis area (i.e., places where large numbers of people would potentially have clear views of the Project Area). KOP locations are shown on Maps 21 and 22; existing views can be found in the visual simulations in Appendix H. The KOPs were then used to inventory existing scenic quality and to analyze the potential impacts from the SSEP. Eighteen of the KOPs lie in the visual analysis area; the nineteenth lies outside of the area (the Quartz Peak KOP) because it was added later at the request of recreational user groups.

3.17.1 Visual Resource Inventory

The Visual Resource Inventory (VRI) process provides the BLM with a means for determining visual values based on scenic quality, viewer sensitivity, and a delineation of distance zones (BLM 1986a). The inventory establishes the baseline, current scenic quality in the visual analysis area, which is used to measure the potential changes to scenic quality caused by SSEP construction and operation. The purpose of a VRI classification is different from VRM class objectives; VRI classes are a tool for portraying the relative value of visual resources and are used to consider visual values in the RMP process. VRM classes are a management tool used to portray visual management objectives. As mentioned above, the Lower Gila South RMP (BLM 1985) identifies VRM classifications in the Project Area.

BLM IM No. 2009-167 states that "All field offices are required to have current VRIs in place and to have VRM classes designated within its LUPs. Both the inventory and management class determinations are critical for baseline NEPA visual impact analysis and compliance evaluation with VRM objectives and for facilitating appropriate advancement of all surface_disturbing, land_use activities, including renewable energy projects."

To comply with IM No. 2009-167 requirements to provide a current VRI (because an outdated one was conducted in 1985 during the RMP process), an interim VRI process for the SSEP was conducted in and adjacent to the Project Area. The inventory was conducted in November 2009 (Johnson 2009) in the interim VRI area, which is based on the Project Area and an approximately 2-mile buffer. The inventory was based on BLM VRM methodology, which consists of three primary components: 1) a scenic quality evaluation, 2) a sensitivity level analysis, and 3) a delineation of distance zones (BLM 1986a). The interim VRI represents the existing visual environment in and adjacent to the Project Area. The total area (of BLM land) inventoried within the interim VRI Area is 26,881 acres.

3.17.1.1 SCENIC QUALITY EVALUATION

Scenery, defined as scenic quality, is a measure of the inherent aesthetic value of the landscape based on existing landscape features, including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (BLM 1986a). Generally, landscapes with a greater diversity of these features tend to receive a higher scenic quality rating. Under the inventory process, the BLM applies three ranks to landscape scenic quality: Class A (outstanding), B (above average), and C (common). The Project Area is located on terrain and vegetation typical of Class C scenery and is characterized by flat to low desert hills and plains, with the low vegetative diversity associated with creosotebush flats. Most of the area is associated with Class C scenery that extends east to west from SR-85 to Rainbow Valley Road and north to south from the Buckeye Hills and the foothills associated with the Sonoran Desert National Monument. Landscapes adjacent to the Project Area include limited Class B scenery associated with agricultural land,

the Buckeye Hills, and the mountain ranges of the Sonoran Desert National Monument (see Map 23). Regionally, several large-scale projects have modified the landscape, including the landfill, tree nursery, minerals plant, agricultural fields, roadways, and utilities (electrical transmission lines and pipelines) within BLM-designated utility corridors (Map 13). Within the interim VRI area, the interim VRI determined that there are 4,474 acres of Class B scenic quality and 22,407 acres of Class C scenic quality (see Map 23). There is no area with Class A scenic quality.

3.17.1.2 SENSITIVITY LEVEL ANALYSIS

Under the VRI process, sensitive viewing locations, or interim observation points (IOPs) (e.g., residences, roads, or trails) are examples of viewpoints that may be affected by visual modifications of the landscape. Under the VRI process, the observation points are called IOPs; during contrast analysis and analysis of project impacts (see section 4.17), these points are called KOPs. The IOPs represent a critical viewpoint or typical viewing condition associated with a sensitive viewer or viewing location. Potential IOPs for the SSEP were identified and field verified (Johnson 2009). The identification of IOPs was based on a review of aerial photography, a review of topographic maps, agency input, suggestions from special interest groups, and field investigations that include photodocumentation using high-resolution photography and global positioning system (GPS) data. Additionally, the selected IOPs are representative of the range of viewing conditions (e.g., elevation) and distance zones for sensitive locations in the visual analysis area. For the SSEP, each IOP was also used as a KOP (see Map 21).

Within the 26,881-acre area inventoried, the interim VRI determined that there are 19,333 acres of landscape with low visual sensitivity, 528 acres with medium sensitivity, and 7,021 acres with high sensitivity (Map 24).

3.17.1.3 DISTANCE ZONES

Distance zones are the viewing distances from IOPs and are defined as foreground/middleground (0–5 miles), background (5–15 miles), and seldom seen (screened within foreground/middleground or beyond background). A total of 19 IOPs was selected to represent "typical" viewing conditions for each of the three sensitive viewing locations (see Map 21): travel routes (five IOPs), recreation areas (eight IOPs), and residences (six IOPs); these are described as follows:

- **Travel Routes**: highways and roads used by origin/destination travelers and designated scenic or historic byways and recreation destination roads (i.e., roads that provide access to designated recreation areas). Travel routes in the visual analysis area include SR-85, Komatke Road, Riggs Road, Estrella Parkway, and Rainbow Valley Road.
- **Recreation Areas**: existing recreation sites used for picnicking, camping, hiking, scenic overlooks, rest areas, or other recreational activities. Viewpoints in the Sonoran Desert National Monument, North Maricopa Wilderness, Sierra Estrella Wilderness, and Buckeye Hills Recreation Area were included.[4]
- **Residences**: single-family structures and permanent mobile homes or mobile home parks. Residences in Goodyear and Rainbow Valley were selected to represent typical residential views of the Project Area. Residences in the background distance zone that would be screened by topography occur in Buckeye, Estrella Mountain Ranch, Palo Verde, Cotton Center, Arlington, Liberty, and Perryville.

[4] Visibility analyses were conducted from Woolsey Peak located in the Woolsey Peak Wilderness, as suggested during a special interest group meeting. Based on the results of the visibility analysis and its distance from the project (approximately 20 miles), Woolsey Peak may have isolated long-distance views for dispersed recreation viewers.

The entire 26,881-acre area inventoried is considered to be within the foreground/middleground distance zone (0–5 miles) (Map 25).

3.17.2 Characteristic Landscape

The Project Area is located in the Basin and Range Province (Fenneman 1931). The Basin and Range Province is distinguished by isolated, roughly parallel mountain ranges separated by closed desert basins. Mountain ranges trend north-south and have distinctive alluvial areas known as bajadas. A subdivision of the Basin and Range Province, the Sonoran Desert, encompasses the entire Project Area and adjacent lands. The Sonoran Desert is characterized by mountains with intervening plains. Vegetation communities that are associated with the Project Area include two subdivisions of the Sonoran Desert (Brown and Lowe 1994), the Arizona Upland and Lower Colorado River Valley.

The Project Area is located in a basin loosely surrounded by the Buckeye Hills to the north, the Estrella Mountains to the east, the Maricopa Mountains to the south, and the Gila Bend Mountains to the west (see Map 21). The landscape of the Project Area is characterized by flat to low desert hills and plains with low vegetative diversity typical of creosotebush flats. Landscapes adjacent to the Project Area include agricultural land, the Buckeye Hills, and the mountain ranges of the Sonoran Desert National Monument. The landscape types in the Buckeye Hills and Sonoran Desert National Monument areas have more visual interest, with increased landform and vegetative diversity, saguaro cacti, and boulder outcroppings.

Cultural modifications contribute to the overall visual character of the Project Area and visual analysis area. Conditions range from natural to completely modified and include pipelines, transmission lines, transportation routes, and other structural features that modify the natural setting (see Map 13). Modifications in the Project Area are limited to dirt surface tracks and roads. Modifications that directly modify the local project setting are located within the BLM-designated utility corridors. The southern utility corridor, which borders the Sonoran Desert National Monument, contains two parallel 500-kV transmission lines and four parallel buried natural gas pipelines adjacent to Komatke Road. The Jojoba Switchyard is located within this utility corridor and connects two 500-kV transmission lines that cross SR-85 from the west and two additional 500-kV transmission lines that approach from the south. The second utility corridor, which includes a 500-kV transmission line, diverges to the northeast at the junction of Haul Road. The visual simulations in Appendix H show the appearance of the utility corridors on the landscape. In addition to the designated utility corridors, a granite mine and processing plant, a large-scale tree nursery, a municipal land fill, and a state prison complex are located west of the Project Area. Several agricultural areas are located in Rainbow Valley east of the Project Area.

The results of the interim VRI process indicate that based on the combination of scenic quality rating units, sensitivity level rating units, and distance zones, the Project Area is in VRI Class IV. This VRI classification is consistent with the current RMP VRM objectives for the Project Area (BLM 1985). Within the interim VRI area, VRI Class IV encompasses 19,332 acres; VRI Class III encompasses 528 acres; and VRI Class II encompasses 7,021 acres.

3.17.3 Visual Resource Management Objectives

Through the land-use planning process, BLM sets objectives for the management of landscape preservation and change. All lands under BLM management jurisdiction are placed into one of four VRM classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where BLM manages for uses that would result in substantial landscape changes (e.g., mining, energy

development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change between Classes I and IV.

The VRM objectives for the Project Area were established in the Lower Gila South RMP (BLM 1985). Lands in the Project Area have been allocated to VRM Class IV objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be a major focus of viewer attention.

3.17.4 Nighttime Lighting and Extent of Skyglow

Amateur astronomers are able to qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness at a specific location (Bortle 2008). Under optimal conditions, the Project Area is assumed to have a Bortle Dark-Sky rating Class 5, equaling that of a typical, suburban sky.

Existing or potential sources of nighttime light in the area include the residences of Rainbow Valley and several industrial or commercial operations, including the landfill, tree nursery, minerals plant, prison, and agricultural fields. Phoenix is the largest source of nighttime light and skyglow in the region and is approximately 30 miles from the Project Area. Other developments associated with Buckeye, Goodyear, and I-10 are approximately 12 miles from the Project Area.

Only hints of zodiacal light are seen on the clearest nights; the Milky Way is very weak or invisible near the horizon and looks washed out overhead; light sources are visible in most, if not all, directions; and clouds are noticeably brighter than the sky.

3.18 Water Resources

3.18.1 Surface Water

3.18.1.1 OVERVIEW

The Project Area is located in the Little Rainbow Valley in portions of the middle Gila River watershed and Lower Gila River Watershed. The Project Area is located south and east of the Gila River between Buckeye and Gila Bend, Arizona and is located on a surface water drainage divide between two tributaries to the Gila River. The western portion of the Project Area is in the Rainbow Wash watershed and drains to small ephemeral tributaries to Rainbow Wash. The eastern portion of the Project Area is in the Waterman Wash watershed and drains to an unnamed tributary that flows to Waterman Wash (Moody and Frazee 2009). This section addresses the surface water resources for the Project Area; the applicable LORS for surface water in the Project Area; as well as the current and proposed drainage patterns across the Project Area.

The analysis area for surface water includes the Rainbow Wash watershed, the Waterman Wash watershed, Rainbow Wash, Waterman Wash, an unnamed tributary that flows to Waterman Wash, and the Gila River reach between Waterman Wash and Rainbow Wash. This analysis area is defined for surface water because a portion of the precipitation that falls on these watersheds flows in washes across the Project Area and discharges to either Rainbow Wash or Waterman Wash, and to the Gila River.

3.18.1.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

3.18.1.2.1 Section 404 of the Clean Water Act of 1972

Under Section 404, the United States Congress gave the U.S. Army Corps of Engineers (USACE) authority to regulate the discharge of dredged or fill material into the waters of the U.S. USACE evaluated the Project Area for waters of the U.S. This evaluation included a Field Survey of Washes and a Significant Nexus Analysis. The Field Survey of Washes identifies potentially jurisdictional washes in the Project Area. The Significant Nexus Analysis is used to determine if there is a significant hydrological, chemical, or ecological connection between on-site washes and the nearest downstream Traditional Navigable Waters (TNW). The USACE determined that a significant nexus does not exist between the washes on-site and the nearest TNW; therefore, there are no waters of the U.S. in the Project Area (Appendix B).

3.18.1.2.2 Federal Emergency Management Agency Floodplains

The current Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map identifies a portion of Rainbow Wash, approximately one mile downstream of the Project Area, as being the only FEMA-regulated floodplain near the Project Area (see Map 7). There are no FEMA-regulated floodplains in the Project Area. However, the FCDMC has recently completed a study of the area that identifies two pending floodplains in the Project Area (see Map 7). These pending floodplains make up approximately 222 acres in the Project Area. A delineation of these floodplains has been submitted to FEMA, which has subsequently issued a letter of "Best Available Data." This Best Available Data letter indicates that the floodplains have been approved and accepted by FEMA; however, they have not been published and therefore are not currently being regulated by FEMA.

Development in existing FEMA-regulated floodplains requires coordination with FEMA through a Letter of Map Change process. A CLOMR must be requested following the design stages of a project, but prior to construction. The CLOMR serves as an assurance from FEMA that any proposed modifications to mitigate a flood hazard meet FEMA's requirements. Following construction, a LOMR must be requested to remove the identified flood hazard areas from FEMA maps. FEMA must issue its own LOMR when pending floodplains are accepted. Development in pending floodplains also requires coordination with FCDMC.

In accordance with the Maricopa County Floodplain Regulations, a Floodplain Use Permit would be required for any development in regulated and pending floodplains located in the Project Area. Most of the Project Area is in the Town of Buckeye and the remainder is in the unincorporated areas of Maricopa County. The Town of Buckeye has entered into an intergovernmental agreement with the FCDMC, which allows the FCDMC to provide floodplain management for the Town of Buckeye. Consequently, FCDMC has jurisdiction to issue a Floodplain Use Permit for the entire Project Area.

3.18.1.2.3 Stormwater National Pollutant Discharge Elimination System/Arizona Pollutant Discharge Elimination System

The EPA National Pollutant Discharge Elimination System (NPDES) regulates stormwater discharge from a large group of industrial activities, including construction. As of December 5, 2002, ADEQ administers the NPDES Program in the State of Arizona under the AZPDES. Where discharges have a potential to enter waters of the U.S. or a storm drain system, an AZPDES permit is required from ADEQ. The SSEP would require an AZPDES Construction General Permit for construction operations.

3.18.1.2.4 Maricopa County

The Maricopa County Department of Planning and Development does not have jurisdiction over federal lands, which include the BLM land on which most of the Project Area is sited. Consequently, the Project would not require a Maricopa County Grading and Drainage Permit or a Drainage Facilities Permit for development on BLM lands. However, the Maricopa County Department of Planning & Development does have jurisdiction over the portion of the access road that crosses state land.

The FCDMC issues Floodplain Use Permits through a cooperative agreement with FEMA. The FEMA requirement includes federal lands and therefore, development on BLM land is not exempt from this process. The SSEP requires a Floodplain Use Permit from FCDMC.

3.18.1.2.5 Town of Buckeye Storm Drainage and Grading Standards and Policies

The Project Area is in the Town of Buckeye's incorporated areas. However, Buckeye does not have jurisdiction over development on federal (BLM) lands. In an effort to foster cooperation, Boulevard would consider the Buckeye's drainage requirements through the development process, except in cases where they conflict with AZPDES or other permit requirements.

The Town of Buckeye requires the following:

- All stormwater that falls within a development, including the respective one-half of all abutting streets, shall retain a minimum of the 100-year, two-hour stormwater runoff within the boundaries of said development. Predevelopment runoff versus post development runoff retention is not acceptable; except for a first flush facility or an approved designated drainage outfall, and shall be approved by the Public Works Department.

- Drainage retention/detention and conveyance systems shall be designed to eliminate and reduce stormwater runoff impact of adjacent or downstream properties. No stormwater drainage system shall be approved if the effect may cause an increase in peak discharge, volume, or velocity of runoff or change the point of entry of drainage onto another property during the runoff event.
- Off-site flows entering the development as a result of the 100-year storm shall be accounted for in flow calculations of entry and exit points on the grading and drainage plans that are to be routed through the development and kept at the original historic points of entry and exit. Off-site flows exiting a development shall not exceed predevelopment flows. If off-site flow terminates within the development, increased amounts of retention would be required. Routing of off-site flows within Town of Buckeye rights of ways are not allowed, except where crossings (culverts, bridges) are permitted by the Public Works Department.
- The site shall provide sufficient stormwater facilities to insure
  - regional stormwater drainage solutions are in accordance with stormwater management programs set forth by the town;
  - the protection of the health, safety and welfare of citizens, their property, the environment, and shall not jeopardize the quality of groundwater resources;
  - minimal adverse impacts of development to existing downstream properties;
  - that all structures, including existing adjacent structures, would be free from flooding and that there is reasonable access for emergency and public service vehicles; and
  - such facilities shall include separate and distinct parcels within the development and shall be planned for accordingly (i.e., retention).

3.18.1.2.6 Arizona Department of Transportation

The primary access to the Project Area is from SR-85. An existing interchange off SR-85 is located near Rainbow Wash and a FEMA designated floodplain. Connection of the primary access road to SR-85 or the existing interchange would require coordination with ADOT for general drainage and FEMA floodplain work. Any portion of the Project Area that falls within the jurisdiction of ADOT would follow the standards and guidelines of ADOT.

3.18.1.3 SURFACE WATER AND CURRENT DRAINAGE CONDITIONS

The most prominent surface water features near the Project Area are the Gila River, Rainbow Wash, and Waterman Wash (Map 26). The western portion of the Project Area drains to Rainbow Wash, whereas the eastern portion drains to an unnamed tributary that flows to Waterman Wash.

The Project Area slopes gently to the north with a grade of approximately 1%. All washes in the watersheds are ephemeral in nature and therefore only flow during, or immediately after, a significant rainfall event. Most of these washes are small erosion features that are less than 5 feet wide. There are no perennial or intermittent watercourses in the Project Area. Within the Project Area there are approximately 41 linear miles of small ephemeral washes. The USACE has evaluated these washes and has determined that they are not waters of the U.S. (see Appendix B).

The topography of the Project Area forms two distinct watersheds; the Rainbow Wash watershed and the Waterman Wash watershed. The Rainbow Wash watershed covers 49 square miles and extends south into the North Maricopa Mountains with elevations ranging from approximately 990 to 1,360 feet above sea level. The Waterman Wash watershed covers 422 square miles. The portion of the Waterman Wash watershed that passes through the Project Area also extends south into the North Maricopa Mountains, with elevations ranging from approximately 800 to 2,813 feet amsl.

3.18.1.3.1 Gila River

The Gila River has its origin in the Mogollon Mountains of west-central New Mexico and eventually joins the Colorado River at Yuma, Arizona. The Gila River watershed drains an area of approximately 58,000 square miles. The Gila River between the confluence of Waterman Wash and the Gillespie Dam contains segments of ephemeral, intermittent, and perennial waters; and a 6.9-mile segment immediately north of the dam that is considered a TNW by USACE (USACE 2008). Agricultural return waters and treated wastewater effluent support intermittent flows in the Gila River in the Southwest Valley (Phoenix) and flows downstream to the Gillespie Dam. The Gila River north of the Project Area only flows as a result of effluent discharges from the 91st Avenue wastewater treatment plant.

3.18.1.3.2 Rainbow Wash

Rainbow Wash is the major water feature in the Little Rainbow Valley. The headwaters of Rainbow Wash are on the north slope of the Maricopa Mountains in the Sonoran Desert National Monument. The western half of the Project Area is drained by Rainbow Wash that flows west and eventually connects with the Gila River approximately 5 miles below the Gillespie Dam.

Rainbow Wash is ephemeral, flowing only during and immediately following large precipitation events. The wash collects sheet flows from the surrounding areas including the western portion of the Project Area and directs them southwest into the Gila River. There are numerous washes in the Rainbow Wash watershed that range in size from small (4 feet wide or less) washes to a few larger washes that are 10 feet wide or more. The washes in this watershed tend to be shallow with depths ranging from 2 feet or less. A few of the larger washes have depths of 3 feet or more. The washes in the Project Area that are in the Rainbow Wash watershed are small ephemeral washes that tend to have long narrow sub-basins ranging from less than 0.33 mile, to a little more than 3.0 miles, before they enter Rainbow Wash. The larger washes in the watershed tend to have higher amounts of vegetation along their banks, and that vegetation tends to be larger in size. The smaller washes tend to have sparser, smaller vegetation along their banks.

Rainbow Wash generally drains from east to west and provides a collection point for stormwater runoff from the north and south sides of the wash. The drainage outfall for Rainbow Wash is the Gila River just downstream of Gillespie Dam.

3.18.1.3.3 Waterman Wash

Waterman Wash is northeast of the Project Area. Waterman Wash is an ephemeral tributary to the Gila River that flows north from the higher elevations southeast of the Project Area and terminating at the Gila River. The unnamed tributary to Waterman Wash is located northeast of the Project Area and flows northeast into Waterman Wash. Numerous small ephemeral washes on the Project Area drain to the unnamed tributary to Waterman Wash. There are numerous washes in the Waterman Wash watershed ranging in size from small (4 feet wide or less) washes to a few larger washes that are 10 feet wide or more. These washes all tend to be shallow with depths ranging from 2 feet or less to depths a little over 3 feet. The washes in the Project Area that are in the Waterman Wash watershed tend to have long narrow sub-basins with lengths ranging from less than 0.33 mile to a little over 9.0 miles before entering into the unnamed tributary to Waterman Wash. The larger washes in the watershed tend to have higher amounts of vegetation along their banks and that vegetation tends to be larger in size. The smaller washes tend to have sparser and smaller vegetation along their banks. A portion of the Waterman Wash watershed drains toward an existing stock pond approximately 1.5 miles before the wash enters the unnamed tributary to Waterman Wash.

The unnamed tributary to Waterman Wash generally drains from southwest to northeast, and provides a collection point for stormwater runoff from the north and south sides of the wash. Waterman Wash, itself, outfalls downstream into the Gila River, upstream of the Gillespie Dam.

3.18.1.4 WATER QUALITY

Every two years, the ADEQ is required by the federal CWA to conduct a comprehensive analysis of water quality data associated with Arizona's surface waters to determine whether state water quality standards are being met and designated uses are being supported. The integrated surface water assessment and impaired waters listing report (2006/2008 Assessment Report) serves to fulfill a national reporting requirement of the CWA, and is submitted to the EPA, and used to report on national water quality issues and concerns. For ADEQ, the assessment provides a mandate to compile environmental data and information from ADEQ's surface water quality protection programs, as well as from other agencies, organizations, and individuals. This comprehensive evaluation of quality of water in Arizona is used to set priorities, allocate resources, and make decisions about land-use activities, discharges to the water, future monitoring, and program initiatives. For the public, the assessment provides an opportunity to learn about and comment on the status of surface water quality in the state.

ADEQ indicates in the assessment that some reaches of the Gila River in the vicinity of the Project Area have been identified as impaired. Several reaches of the Gila River downstream of the Project Area are impaired by low dissolved oxygen, selenium, boron, dichlorodiphenyltrichloroethane (DDT) metabolites, toxaphene in fish tissue, and chlordane in fish tissue. There are no data available in this report specific to Waterman Wash or Rainbow Wash. Additionally; there are no sediment load data available for these reaches of the Gila River.

The elements boron and selenium as a pollutant are typically associated with agricultural irrigation practices. Pesticide residues such as DDT metabolites, toxaphene, and chlordane are also a result of agricultural practices. The low dissolved oxygen is typically the result of biodegradable organic compounds that come from agricultural operations or urban areas. Low dissolved oxygen primarily results from excessive algae growth caused by phosphates and nitrates (the ingredients in fertilizers). As the algae die and decompose, the process consumes dissolved oxygen. Therefore, due to the lack of agricultural operations or urbanization in the watershed of the washes on-site, these washes do not have a significant potential to contribute to the further impairment of these waters.

3.18.1.5 STREAM FLOW DATA

Stream flow measurement gages are not present in the Project Area. However, FCDMC has installed two gages in the area as a part of its Automated Local Evaluation in Real Time (ALERT) stream and weather gage network. Both gages are equipped to measure stream flow in terms of stages in the watercourse. These gages are located on Rainbow Wash and Waterman Wash (see Map 26). The stream gage on Rainbow Wash is located approximately 4 miles downstream (east) of the main solar field. The stream gage on Waterman Wash is located approximately 4 miles above its confluence with the unnamed tributary to Waterman Wash.

The FCDMC Rainbow Wash gage identification (ID) is No. 6953 and the Waterman Wash at Rainbow Valley Road, ID is No. 6833. The Rainbow Wash gage has available data from November 2000 to the present and has a drainage area of 17.6 square miles. The Waterman Wash at Rainbow Valley Road gage has available data from March 1999 to present and has a drainage area of 362 square miles. Drainages areas for each gage were obtained from the FCDMC (Maricopa 1998–2007).

The Waterman Wash gage records stream flow from 362 square miles of the Waterman Wash and is not representative of flow in the small washes in the Project Area. Therefore, the Rainbow Wash flow data are the best source of hydrologic data to estimate the stream flows from both watersheds. Furthermore, the Rainbow Wash watershed's proximity and other similarities of hydrologic characteristics, such as elevation, slope, vegetation, and soil types make this a relevant comparison.

FCDMC lists 31 storm runoff events at the Rainbow Wash gage occurring between March 7, 2001 and August 13, 2009. The mean number of storm runoff events over this period of time at the Rainbow Wash gage is approximately four storm events per year (31 storm events, divided by eight years). Of these 31 runoff events, the maximum flow was 1,827 cfs and the minimum flow was 37 cfs. The total duration of flow over the eight years was 228 hours with an average storm event of 7 hours. The average mean annual flow for these eight years of data, as reported by FCDMC is 0.22 cfs. The Rainbow Wash watershed contributing to the gage is 17.6 square miles.

3.18.1.6 DRAINAGE AREA DELINEATION METHODOLOGY

Drainage areas and boundaries were estimated using existing topographic mapping, aerial photography, and field visits. Where detailed topographic information was available, 2-foot contours were used to estimate the drainage boundaries. Where detailed topographic information was unavailable, the U.S. Geological Survey (USGS) 7.5-minute quadrangle maps were used.

3.18.1.6.1 Existing Drainage Studies

Several surface water studies have been prepared for the watersheds. These studies have been collected and used to better understand the existing drainage condition of the watersheds. A brief synopsis of these studies and how they are used in the drainage analysis is presented below.

An area drainage master plan is currently being prepared for FCDMC by URS Corporation and includes portions of the Project Area that drains toward Waterman Wash. Selected parameters from the study have been used as part of the hydrologic study of the Project Area. These parameters include percent vegetation cover, soils data, land-use type, distributary-flow rating curves, and Manning's n values for the washes. Some of the sub-basins were broken into smaller sub-basins where a greater level of hydrologic detail was needed.

The FCDMC has recently mapped some of the floodplains on the Project Area in the Waterman Wash and Tributaries Floodplain Delineation Study by Engineering and Environmental Consultants Inc. (EEC) and submitted these maps to FEMA. The pending FEMA floodplains in the EEC study would be used as the best available data for the washes that were mapped as part of the study. In addition the currently mapped FEMA floodplain for portions of Rainbow Wash downstream of the Project Area would also be used.

3.18.2 Groundwater Resources

3.18.2.1 OVERVIEW

Groundwater would be required to supply water for the project due to the unavailability or insufficient supply of water from alternative sources, including surface water and reclaimed water. Groundwater to supply the SSEP would be pumped from an on-site well field under a GIU groundwater withdrawal permit.

The analysis area for groundwater is the Rainbow Valley Sub-basin. Because the groundwater resource available to supply the SSEP is contained within the Rainbow Valley Sub-basin, the groundwater resource evaluation focused exclusively on Rainbow Valley Sub-basin.

3.18.2.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Groundwater resources in Arizona are regulated under the Arizona Groundwater Code (A.R.S. Title 45, Chapter 2) through the ADWR. Under the Groundwater Code, groundwater development is restricted and intensively managed within five AMAs: Phoenix, Pinal, Prescott, Tucson and Santa Cruz. The groundwater resource that would be used to supply water for the SSEP is contained in the Rainbow Valley Sub-basin of the Phoenix AMA. The key regulatory requirements imposed by the Groundwater Code that apply to groundwater development for the SSEP are the need to obtain either a groundwater right or a groundwater withdrawal permit to pump groundwater, and compliance with ADWR well spacing and well impact requirements, as described in the following subsections.

There are no specific federal laws, Maricopa County ordinances or local ordinances that regulate the development of groundwater resources for the SSEP. All AMA-specific requirements under the Groundwater Code are applicable to all jurisdictions within an AMA, including land controlled by the BLM.

3.18.2.2.1 Grandfathered Groundwater Rights

A well owner must have either a grandfathered right (GFR) or a groundwater withdrawal permit to legally pump groundwater within an AMA at a rate in excess of 35 gpm. GFRs are authorized under A.R.S. Title 45, Chapter 2, Article 5, and are classified as follows:

- Irrigation GFRs: Irrigation GFRs allow groundwater to be used only for irrigation purposes on the land where the groundwater is pumped.
- Type 1 Nonirrigation GFRs: A Type 1 Nonirrigation GFR can be obtained by converting an Irrigation GFR to a Type 1 Nonirrigation GFR; however, the water is still appurtenant to the land and must be used on the land where the groundwater is pumped.
- Type 2 Nonirrigation GFRs: Type 2 Nonirrigation GFRs can be used anywhere within an AMA, and can be purchased or leased.

Given that there is no irrigated land in the Project Area, a Type 2 GFR is the only type of grandfathered water right potentially available in the Project Area.

3.18.2.2.2 Groundwater Withdrawal Permits

Groundwater withdrawal permits are authorized under A.R.S. Title 45, Chapter 2, Article 7. There are seven categories of groundwater withdrawal permits that can be obtained from ADWR. Of these, the only type of permit applicable to the SSEP is a GIU permit (A.R.S. § 45-515), which allows groundwater to be withdrawn "from a point outside of the exterior boundaries of the service area of a city, town or private water company for a GIU outside of the exterior boundaries of such service area", subject to the following conditions (as paraphrased from A.R.S. § 45-515):

- Uncommitted municipal and industrial CAP water is not available at the point where the operator's wellhead or distribution system would otherwise be, at a cost which does not exceed the current municipal and industrial CAP rates.

- Other surface water of adequate quality or effluent of adequate quality is not available at the point where the operator's wellhead or distribution system would otherwise be, at a cost, including treatment costs, which does not exceed by 25% of the cost the operator would otherwise incur in withdrawing groundwater.
- Irrigation GFRs appurtenant to acres of land in reasonable proximity to the intended GIU are not available for purchase at a reasonable price or cannot be acquired by eminent domain and the applicant does not own or lease GFRs that the applicant is not using or leasing, that may be used for the intended GIU and that can be used for the intended GIU without imposing an unreasonable economic burden on the applicant.
- The intended GIU, if located within 3 miles of the exterior boundaries of the service area of a city, town or private water company, has been denied service by the city, town or private water company at the customary rate in the customary manner.
- The management plan for the AMA can be adjusted to accommodate the intended GIU consistent with the achievement of the management goal for the AMA.
- There is an assured water supply for the intended use at the intended point of withdrawal. For purposes of this section, "assured water supply" means that sufficient groundwater of adequate quality would be available to satisfy the projected GIU for the duration of the permit.
- The assured water supply demonstration is not specifically listed on the GIU application form, but is referenced in the statute (A.R.S. § 45-515.6). The applicant must demonstrate that pumping to supply the project would not cause the water level to decline to more than 1,000 feet below land surface (bls) over the planned life of the project, which is consistent with ADWR's assured water supply requirements for subdivisions. This demonstration has been made for the SSEP through the development, calibration and application of a groundwater flow model, as described in Section 4.15. The SSEP meets all of the conditions listed above; therefore, groundwater to supply the SSEP would be pumped under a GIU permit. The SSEP GIU permit application has been approved by ADWR and includes stipulations to monitor and report groundwater withdrawals.

3.18.2.2.3 Well Spacing and Well Impact

New groundwater production wells that would pump more than 35 gpm must meet ADWR's well spacing and well impact requirements prescribed under 12 A.A.C. Chapter 15, Article 13. To meet the requirements, an applicant must demonstrate that pumping the new wells would not cause the water level in any neighboring well of record to decline by more than 10 feet over five years. This demonstration has been made for the SSEP groundwater production well field through the use of the same groundwater flow model developed for the GIU, as described in Section 4.18. The SSEP GIU permit application is pending, and is currently under review by ADWR.

3.18.2.3 EXISTING CONDITIONS

3.18.2.3.1 Physical Geographic Setting

The analysis area is located in the Basin and Range Province, a region characterized by generally north- to northwest-trending, fault-bounded mountain ranges and broad, interconnected alluvial basins that form regional aquifers. Of the total Project Area (3,620 acres), approximately 3,601 acres (approximately 97%) are in the northwestern part of the analysis area (Map 27). Because the groundwater resource available to supply the SSEP is contained in the Rainbow Valley Sub-basin, the groundwater resource evaluation focused exclusively on Rainbow Valley Sub-basin (the analysis area).

The Rainbow Valley Sub-basin encompasses an area of about 420 square miles and consists primarily of agricultural land in the north and undeveloped desert land in the south. Developed and privately owned agricultural land lies east and south of the undeveloped Project Area. The boundaries of the sub-basin are defined on the north by the Buckeye Hills and the northern part of the Sierra Estrella, on the west and southwest by the Maricopa Mountains, on the southeast by the Haley Hills, Booth Hills and Palo Verde Mountains, and on the east by Sevenmile Mountain and the southern part of the Sierra Estrella (see Map 27). The sub-basin is drained by Waterman Wash, an ephemeral stream that flows northwest and joins the Gila River near Buckeye (ADWR 1994).

3.18.2.3.2 Geologic Setting

The mountains that form the boundaries of the Rainbow Valley Sub-basin are composed of Precambrian granitic rocks ranging in composition from granite to gabbro, and metamorphic rocks that include metasedimentary, metavolcanic, and granitic gneissic rocks (Richard et al. 2000; Reynolds and Skotnicki 1997; Skotnicki 2002a and 2002b). The Precambrian bedrock outcrops are shown on Map 10. Granitic and metamorphic rocks typically yield little groundwater and effectively form barriers to groundwater flow. The regional aquifer is contained in the intermontane basin-fill deposits, which consist of poorly sorted gravel, sand, silt and clay (White 1963). Depth to bedrock ranges from a few feet near the sub-basin margins to more than 1,260 feet in the north-central part of the sub-basin (White 1963) and may exceed 9,600 feet in the deepest part of the sub-basin (Oppenheimer and Sumner 1980; Richard et al. 2007). The northern and western parts of the analysis area are characterized by exposed or shallow bedrock.

3.18.2.3.3 Groundwater Elevations and Flow Directions

Groundwater elevations in the Rainbow Valley Sub-basin are illustrated on Map 27. The groundwater elevation contours shown on the map were prepared using 2002 and 2003 water level data obtained from the Groundwater Site Inventory (GWSI) database (ADWR 2009a). The GWSI database contains records for thousands of wells in Arizona that have been physically located and inventoried in the field by ADWR or USGS. There are no well records in GWSI database for the Project Area. However, there are wells within the analysis area as discussed below in "Groundwater Development and Current Uses,"

Groundwater flow in the Rainbow Valley Sub-basin is generally northwest, parallel to the mountains that form the sub-basin boundaries. In the northern part of the sub-basin, east of the Project Area, groundwater flows toward a cone of depression in T2S, R2W, created by groundwater pumping for agricultural irrigation (ADWR 1994). Groundwater elevations range from approximately 1,000 feet amsl in the southeast, between the Palo Verde Mountains and Haley Hills, to less than 750 feet amsl within the cone of depression in the north. The average hydraulic gradient of the groundwater surface is approximately 0.002 feet per foot in the central and southern parts of the sub-basin, and about 0.01 feet per foot at the edge of the cone of depression.

Groundwater elevations and flow directions across most of the Project Area are not well defined due to a lack of reliable water level data. However, reported water level data from the Well Registry Database (ADWR 2009b) indicate that the groundwater surface across the Project Area is relatively flat. Groundwater elevations in the northwestern part of the Project Area are lower than in the southeastern part of the Project Area, indicating that groundwater in the Project Are is flowing west, toward the Gila Bend Basin. Based on the limited depth to groundwater data in the Project Area, the average depth to groundwater across the Project Area is estimated to be slightly greater than 300 feet bls.

3.18.2.3.4 Depth to Groundwater

The depth to groundwater in the northern part of the analysis area ranges from less than 100 feet bls on the shallow pediment near the Buckeye Hills to approximately 350 feet bls in the adjacent cone of depression. Elsewhere in the analysis area the depth to groundwater ranges from about 350 to 450 feet bls, and is approximately 400 feet bls in the southern part of the analysis area, near Mobile (Rascona 2005).

3.18.2.3.5 Sources of Groundwater Recharge and Discharge

Groundwater recharge to the Rainbow Valley Sub-basin (analysis area) consists of infiltration from agricultural irrigation occurring primarily in the northern part of the sub-basin, mountain front recharge, and stream channel recharge from flood-stage flows in Waterman Wash. Groundwater recharge in the vicinity of the Project Area is believed to be minimal due to the lack of agricultural irrigation, a primary stream channel or a mountain front capable of providing recharge, and significant loss of water vapor. Groundwater pumping is the primary source of discharge from the Rainbow Valley Sub-basin (ADWR 1994), but is relatively insignificant in the Project Area.

3.18.2.3.6 Groundwater Development and Current Uses

Groundwater development for agricultural irrigation in the northern part of the Rainbow Valley Sub-basin began in the early 1950s and expanded rapidly until about 1960. In 1961, a total of 16,000 acres of land was under irrigation (ADWR 1994). Groundwater pumping for irrigation increased substantially through the 1950s, remained relatively constant from about 1960 until the early 1980s, and then began declining in the early 1980s as agricultural land was taken out of production. Most of the groundwater production wells in the northern part of Rainbow Valley are currently used for agricultural irrigation, although total groundwater withdrawals from pumping for agricultural irrigation are now substantially less than they were in the 1960s and 1970s. A few wells in the northern part of Rainbow Valley are used for domestic supply. Registered wells in the analysis area are listed in Appendix C. The table was prepared from the ADWR Well Registry Database (ADWR 2009b) and includes all wells registered with ADWR after 1980.

3.18.2.3.7 Water Level Trends

ADWR maintains a statewide network of water level index wells for monitoring groundwater conditions. Static water levels are measured annually in the index wells, with the new data added to the water level file in the GWSI database (ADWR 2009a). A total of 24 index wells is located in the Rainbow Valley Sub-basin; 12 of the index wells are located in the northwestern part of the sub-basin, within approximately 7 miles of the proposed groundwater production well field. Index well locations are shown on Map 27.

Water level data with long-term periods of record, some of which extend as far back as the 1950s, show steadily declining water levels from about 1950 to 1980 as a result of groundwater development for agricultural irrigation. Water levels in the northern part of the sub-basin have risen or stabilized since the 1980s due to decreased groundwater pumping for agricultural irrigation, but have continued to decline in the south. The average, long-term water level decline rate for the Rainbow Valley Sub-basin is about 1 foot per year. The average decline rate for the northwestern part of the sub-basin is approximately 0.75 foot per year, based on historic water level data from the 12 index wells located closest to the proposed groundwater production well field.

3.18.2.3.8 Existing Well Yield

Existing high capacity production wells in the northern and central parts of the Rainbow Valley Sub-basin have reported pumping capacities that range from about 500 gpm to as high as 3,690 gpm, with most wells ranging from about 1,200 to 2,000 gpm (ADWR 2009a). There are no pumping data in the GWSI database for wells located in the southern part of the sub-basin; however, reported data from other sources indicate that existing high capacity production wells in the area typically yield less than 1,000 gpm (Clear Creek Associates 2005). The few wells that have been constructed in the Project Area are all exempt wells designed to pump less than 35 gpm; therefore, the potential well yield for most of the area is unknown.

3.18.2.3.9 Specific Capacity and Aquifer Transmissivity

Specific capacity data are obtained from short-term aquifer tests by dividing the pumping rate (Q) in gpm by the total drawdown (s) in feet, which yields specific capacity (Q/s) in gpm per foot (gpm/ft). Specific capacity can be used to estimate aquifer transmissivity (T) by multiplying specific capacity by a conversion factor of 2,000 for unconfined conditions to obtain T in gallons per day per foot (gpd/ft) (Driscoll 1986, Appendix 16.D). Hydraulic conductivity (K) in feet per day (ft/d) is calculated by dividing T by the screened interval of the well (b) in feet.

There are 31 wells located in the northern and central parts of the analysis area (T2S, R2W) with specific capacity data available from the GWSI database (ADWR 2009a); 12 of the wells are located in the northwestern part of the analysis area, within approximately 4 miles of the Project Area. There are no wells in the southern part of the analysis area with specific capacity data in GWSI. The specific capacity data from GWSI are listed in Appendix D, along with their respective estimated T and K values. Estimated T values for the 12 wells near the Project Area range from approximately 18,000 to 141,000 gpd/ft, and the corresponding K values range from about 4 to 33 ft/d.

3.18.2.3.10 Groundwater Quality

Published groundwater quality data indicate that groundwater in the northern agricultural part of the Rainbow Valley Sub-basin (analysis area) is unsuitable for potable use (ADWR 1994). TDS concentrations range from about 400 milligrams per liter (mg/L) to more than 2,700 mg/L; fluoride concentrations range from 1.0 to 10.0 mg/L (Stulik 1982). There is no primary drinking water standard for TDS; the secondary maximum contaminant level (SMCL) for TDS (secondary drinking water standard) is 500 mg/L. The Maximum Contaminant Level for fluoride is 4.0 mg/L; the SMCL is 2.0 mg/L.

3.18.2.4 GROUNDWATER AVAILABILITY

A groundwater resource evaluation was conducted for the SSEP to characterize the physical availability of groundwater to meet the water supply requirements of the SSEP. The scope of the evaluation consisted initially of preliminary (desktop) investigations based on publicly available data. The results of the preliminary investigations indicated that most of the Project Area is not suitable for groundwater development due to exposed or shallow bedrock and limited aquifer thickness, but that a sufficient groundwater supply could be present in the southeastern part of the area, subject to confirmation through exploratory drilling and aquifer testing (Golder 2008a; 2008b). A gravity survey of a portion of the analysis area was first completed to identify a suitable target area for drilling (Golder 2009a), followed by exploratory drilling and testing to characterize the groundwater resource.

3.18.2.4.1 Gravity Survey

A gravity survey was conducted to characterize the depth to bedrock and geometry of the northwestern part of the analysis area to focus the exploratory drilling and testing program on the area of highest groundwater development potential (Golder 2009a). The scope of work consisted of the planning, acquisition, reduction, presentation, and interpretation of gravity data for a portion of the analysis area. One hundred seventy-seven gravity measurements were collected in the field and processed in conjunction with 15 existing and publicly available gravity data points. The data were used and modeled to produce an interpreted depth-to-bedrock map of a portion of the analysis area.

The gravity modeling results indicate that depth to bedrock in a portion of the analysis area ranges from 0 to approximately 2,800 feet, with the greatest depths occurring east of the Project Area boundary, within the eastern third of the area of investigation. The thickest basin-fill deposits, as determined by the gravity survey (Carr 2010), are located in a portion of the analysis area within parts of Sections 24 and 25 (T2S, R3W), and Sections 29 and 30 (T2S, R2W), at the eastern Project Area boundary.

The average depth to groundwater in the northern part of the analysis area is approximately 400 feet. Assuming the depth to groundwater is approximately 400 feet across the eastern part of the analysis area, a bedrock depth of 1,000 feet would equate to a saturated basin-fill aquifer thickness of 600 feet, a suitable thickness for groundwater development provided that the aquifer transmissivity is sufficiently high.

3.18.2.4.2 Groundwater Exploratory Drilling and Testing

Based on the results of the gravity survey, a groundwater exploratory drilling and testing program was conducted to acquire hydrogeologic data to characterize the physical availability of groundwater to supply the SSEP. The methodology of the program was provided to BLM prior to drilling and comments from the BLM were incorporated into the program. Details of the program can be found in the *Groundwater Resource Evaluation* (Carr 2010) and are summarized briefly below. The main components of the exploratory program included exploratory boring drilling and logging; depth-specific (zonal) testing and analysis; monitoring well installation and development; test well installation and development; and aquifer testing and analysis.

3.18.2.4.3 Exploratory Borings and Wells Completed

Four exploratory borings (EB-1 through EB-4), one monitoring well (MW-1) and one test well (TW-1) were completed during the exploratory drilling and testing program. All of the exploratory borings and wells are located in Section 29 (T2S, R2W) and are shown on Map 28. The legal locations of the exploratory borings and wells are listed in Table 3.53.

Table 3.53 Locations of Exploratory Borings and Wells

Drilling Location	Section	Township	Range	160-acre	40-acre	10-acre	Cadastral Location
EB-1	29	2S	2W	NE	NW	NE	C(2-2)29aba
EB-2	29	2S	2W	NW	SE	SW	C(2-2)29bdc
EB-3	29	2S	2W	NW	NE	NW	C(2-2)29bab
EB-4	29	2S	2W	NE	SE	SW	C(2-2)29adc
MW-1	29	2S	2W	NE	NW	NE	C(2-2)29aba
TW-1	29	2S	2W	NE	NW	NE	C(2-2)29aba

3.18.2.4.4 Exploratory Boring Drilling and Logging

The four exploratory borings (EB-1 through EB-4) were drilled and logged to characterize subsurface lithology and verify depth to bedrock (if encountered). The boreholes were advanced to total depths ranging from approximately 1,100 to 1,500 feet bls and never encountered bedrock. Drill cuttings were logged in the field and the completed boreholes logged by a geophysical logging contractor.

Three distinct hydrogeologic units were noted in the exploratory borings: an upper unit consisting of sand and gravel, a middle unit consisting mainly of clay and silty clay, and a lower, highly consolidated conglomerate. Based on observations made during the SSEP exploratory drilling program, the upper unit near the Project Area consists primarily of gravel, sand, and silt, and occurs from 0 to approximately 920 feet bls. The middle unit consists of clay, silt, mudstone, and very-fined grained sand with some interbedded sand and gravel, and occurs from about 920 to 1,100 feet bls. The lower unit consists of conglomerate, gravel, decomposed metamorphic rocks, and alluvium, and occurs from about 1,100 feet bls to bedrock.

3.18.2.4.5 Depth-specific (zonal) Testing and Analysis

Five intervals were selected from each exploratory boring for depth-specific (zonal) testing using information from the lithologic and geophysical logs. The testing of each interval consisted of groundwater sampling, followed by the completion of falling head tests. The zonal testing results provided depth-specific information on groundwater quality and aquifer production potential, and were used to develop an appropriate test well design.

Zonal sampling and testing was performed using a perforated eductor pipe, placement of a sand envelope around the perforated zone, and isolation of the zone with bentonite seals. Each interval was purged by airlifting prior to sample collection. Each zonal sample was analyzed for major ions, indicator parameters and selected metals by an Arizona-certified analytical laboratory. After each sample was collected, a falling head test was performed to estimate depth-specific K using an electronic pressure transducer (i.e., pressure sensor) and a laptop computer. Data from the pressure transducer were evaluated using the Unconfined Bouwer-Rice Solution (Bouwer and Rice 1976) to calculate a value of K in ft/d for each zone.

3.18.2.4.6 Zonal Groundwater Sampling Results

The analytical methods and results for the groundwater samples are found in the Groundwater Resource Evaluation (Carr 2010) and are summarized in this paragraph. TDS values range from 800 to 7,900 mg/L. However, the sample with the highest TDS value (7,900 mg/L), obtained from the lowermost zone at EB-3, is thought to have been impacted by residual drilling fluid and is therefore not representative of groundwater quality conditions. The remaining TDS values range from 800 to 2,500 mg/L. Most of the higher values (1,200 to 2,500 mg/L) were observed in the samples collected from either the middle or the lower unit, below the productive part of the aquifer. Most of the TDS values from the zones completed in the upper unit range from 800 to 1,200 mg/L, with a single outlier (1,700 mg/L) from the middle zone at EB-3.

3.18.2.4.7 Falling Head Test Results

The falling head test results were used to calculate values for K and T for each zone by multiplying K by the screened interval (b) represented by the zone. Each T value was converted into a specific capacity value, then into an estimated well capacity value assuming a drawdown of 100 feet. The falling head test results indicate that the estimated K of the upper unit is substantially higher than the estimated K of the underlying middle and lower units; therefore, the total well capacity for each drilling site was estimated using only the test results from zones completed in the upper units. The well capacities estimated using this method range from 1,000 to 2,400 gpm.

3.18.2.4.8 Test Well and Monitoring Well Installation and Development

In order to perform tests on the aquifer to confirm the results of the exploratory program, a test well and a monitoring well were installed and developed. Exploratory boring EB-1 was selected for completion as a test well, which was designated TW-1. The EB-1 site was selected for the test well based primarily on its location, which is slightly closer to the center of the analysis area than the other three sites. The site was also selected based on the logs and zonal testing results from the exploratory boring, which indicated the presence of a productive aquifer to a depth of 920 feet. The design of TW-1 was finalized using the data collected during the logging and testing of EB-1. A monitoring well (MW-1) was installed approximately 35 feet from the test well (TW-1) to allow water level data to be collected during the aquifer tests.

Well TW-1 was installed to a depth of 940 feet and constructed with 16-inch diameter steel casing to accommodate the installation of a high-capacity pump for testing. Monitoring well MW-1 was installed to a depth of 600 feet and constructed with 4-inch diameter polyvinyl chloride casing. Details on the installation and development of wells TW-1 and MW-1, including as-built diagrams, are provided in the Groundwater Resource Evaluation (Carr 2010).

3.18.2.4.9 Aquifer Testing and Analysis

Aquifer testing consisted of a 10-hour, step-rate pumping test to evaluate well yield, specific capacity and well efficiency followed by a 72-hour, constant-rate aquifer test to estimate the transmissivity and storativity of the aquifer, confirm the well yield and specific capacity obtained from the step-rate pumping test, and evaluate conditions that could affect the well's discharge capacity after an extended period of pumping. Testing activities are extensively documented in the Groundwater Resource Evaluation (Carr 2010). The water level drawdown and recovery data from the constant-rate aquifer test were analyzed using the Cooper-Jacob (1946) method for analysis of the early time drawdown data, the Moench (1997) method for analysis of the late time drawdown data, and the Theis (1935) recovery method.

The results of the step-rate pumping test indicate that the well efficiency is relatively high and declines only slightly, from 93% to 87%, between 800 and 1,600 gpm. Similarly, specific capacity declines slightly over the same pumping range, from about 20 to 19 gpm/foot. A pumping rate of 1,400 gpm was selected for the constant-rate test based on the results of the step-rate test. The water level drawdown from the constant rate test at the end of 72 hours of pumping was 73.8 feet in well TW-1, with a pumping water level of about 435.5 feet bls. This translates to a specific capacity of 19.1 gpm/foot of drawdown at an average discharge rate of 1,411 gpm. The water level in well MW-1 at the end of the test was 27.9 feet, corresponding to a water level of 389.3 feet bls. At the end of 30 hours of recovery, the residual drawdown in the test well was approximately zero, a recovery of 100%. Groundwater was also sampled during this process and was found to have a TDS concentration of 800 mg/L.

3.18.2.5 SUMMARY OF GROUNDWATER AVAILABILITY

The results of the groundwater resource evaluation indicate that there is a sufficient supply of groundwater at the location of the proposed groundwater production well field in Section 29 (T2S, R2W) to meet the water supply requirements of the SSEP. Groundwater exploratory drilling verified that the basin-fill aquifer is productive to a depth of approximately 920 feet bls with a saturated thickness of about 560 feet, and that subsurface conditions are similar at all four drilling sites. The results of the step-rate pumping test at well TW-1 indicate that the well can be pumped at a rate of 1,400 gpm with a water level drawdown of about 75 feet. The results of the constant-rate aquifer test at well TW-1 resulted in estimated T values ranging from approximately 44,000 to 59,000 gpd/ft, estimated K values ranging from 15 to 20 ft/d, and an S value of 0.12.

3.19 Wildlife and Special-status Species

3.19.1 Overview

The area of analysis for wildlife resources consists of the Project Area (see Section 3.1.1) and includes portions of the Buckeye Hills and the North Maricopa Mountains. The analysis area includes these hills and mountains because certain wildlife species may pass through the Project Area while in transit between these areas. The analysis area also includes portions of the Gila River, Rainbow Wash, and an unnamed tributary to Waterman Wash. Wash habitat is included in the analysis area due to the potential for high wildlife species richness and the potential for use as wildlife travel corridors.

3.19.2 Laws, Ordinances, Regulations, and Standards

Developments that include ground-disturbing activities or placement of structures may impact special-status species or their habitats. As such, laws have been developed for their protection, and where applicable, are considered during project resource reviews. The following LORS are applicable to the wildlife related aspects of the SSEP.

3.19.2.1 ENDANGERED SPECIES ACT SECTION 7 (16 U.S.C. § 1531, AND 50 CFR § 17.1)

The ESA of 1973 directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. Section 7 of the act is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the continued existence of any listed species.

The BLM has initiated informal consultation with USFWS for the SSEP. A BA was completed for the SSEP and has determined that there would not be any project-related impacts to any federally listed species and/or their designated critical habitat because suitable foraging and/or breeding habitat is not present in the Project Area (EPG 2009). The USFWS has provided concurrence for this determination (USFWS 2010).

The federal Migratory Bird Treaty Act of 1918 (MBTA) provides protection for 836 bird species present in the United States, most of which are migratory. The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell most birds listed under the act. The legal take of game bird species is allowed. The statute is described in more detail in Section 3.19.4.1 below along with the migratory birds present in the Project Area.

3.19.2.2 BALD AND GOLDEN EAGLE PROTECTION ACT (16 U.S.C. § 668; 50 CFR § 22 ET SEQ.)

The Bald and Golden Eagle Protection Act (Eagle Act) prohibits any form of possession or taking of bald eagles (*Haliaeetus leucocephalus*) or golden eagles. A 1962 amendment to the MBTA created a specific exemption for possession of an eagle or eagle parts (e.g., feathers) for religious purposes of Indian tribes. The amendment provided for not only the preservation of the golden eagle, but also the preservation of Native American cultural practices.

The USFWS finalized new permit regulations authorizing the limited take of bald eagles and golden eagles under the Eagle Act on September 11, 2009. The rules, which went into effect November 10, 2009, established a regulatory mechanism to permit take comparable to incidental take permits under the ESA.

The rules allow the USFWS to authorize take associated with otherwise lawful activities where the take is compatible with preservation of the bald and golden eagle and cannot practicably be avoided. The Eagle Act defines "take" to include a broad range of actions, including disturbing eagles. Notably, the new rules were developed because "many actions that are considered likely to incidentally take (harm or harass) eagles under the ESA will also disturb or otherwise take eagles under the Eagle Act."

A regional bald and golden eagle nest location survey was conducted by the AZGFD in 2011. No suitable habitat is present in the Project Area for bald eagles. The nearest documented bald eagle breeding area is located 17 miles away. However, recognition of the existing law is included in the project review process to ensure complete compliance with the Eagle Act.

3.19.2.3 BLM SENSITIVE SPECIES

The BLM manages habitat for wildlife on public lands, and the AZGFD maintains and manages the state's wildlife resources. The BLM sensitive species list for the LSFO consists of species that are federally protected under the ESA and MBTA and species that are protected by state laws, including plant and animal species, game species, and migratory birds. These species need to be addressed because BLM policy (Manual Section 6840) dictates that the BLM must carry out management for the conservation of state-listed plants and animals in addition to species protected under the ESA. BLM Manual Section 6840 is a federal guidance document that outlines the criteria for listing species as sensitive on BLM-administered lands and provides direction on management of these species. BLM sensitive species are species that the USFWS currently lists under status review; species whose populations are declining rapidly and may warrant federal protection in the future; species that have small, widely distributed populations; and species that are located in special or unique habitats. IM No. AZ-2006-002, Change 1, dated September 30, 2006, provides a current update of the species list designated as sensitive by the BLM in Arizona.

3.19.2.4 AZGFD WILDLIFE OF SPECIAL CONCERN

A.R.S. Title 17 directs the responsibility for maintaining and managing the state's wildlife resources to the AZGFD and Commission. According to A.R.S. § 17-102, most wildlife in Arizona is the property of the state. A.R.S. § 17-231 allows the commission, among other things, to 1) establish policies and programs for the management, preservation and harvest of wildlife; 2) establish hunting, trapping and fishing rules and prescribe the manner and methods that may be used in taking wildlife; 3) enforce laws for the protection of wildlife and wildlife habitat; and 4) develop and distribute information about wildlife and activities of the department.

The AZGFD lists various species as wildlife of special concern (WSC). WSC are wildlife species that are or may be in jeopardy in Arizona or with known or perceived threats or population declines. AZGFD manages all wildlife species in Arizona. AZGFD maintains a statewide database, the Heritage Data Management System (HDMS), which tracks records for federally listed species and other species of special concern. The HDMS was accessed through the Arizona Heritage Geographic Information System (AZHGIS) online environmental review tool to determine whether any federally proposed or designated critical habitat or special-status species have been documented in or near the Project Area (AZHGIS 2009). The response letter provides information on special-status species, the presence or absence of designated critical habitat, special handling guidelines for wildlife, and preliminary project-type recommendations, as given by the AZGFD.

3.19.2.5 USFWS BIRDS OF CONSERVATION CONCERN

The 1988 amendment to the Fish and Wildlife Conservation Act, Birds of Conservation Concern (BCC), mandates the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA." The overall goal is to accurately identify the migratory and nonmigratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities of the USFWS. This assessment is derived from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the U.S. Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Bird species considered include nongame birds, gamebirds without hunting seasons, and ESA candidate, proposed endangered or threatened, and recently delisted species. Assessment scores from all three bird conservation plans are based on several factors, including population trends, threats, distribution, abundance, and relative density. The goal of the USFWS regarding BCC species is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions. The USFWS recommends that these lists be consulted in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (USFWS 2008).

3.19.3 Field Reconnaissance

Biological field reconnaissance surveys were conducted to support the information in this document (Pape 2009). These surveys were conducted and were consistent with input received from the USFWS, AZGFD, and BLM in pre-survey coordination meetings. Due to the absence of endangered species or suitable habitat in the Project Area, no "protocol" surveys were deemed necessary. Reconnaissance surveys were conducted in the Project Area and within a 2-mile buffer around the Project Area boundaries. Reconnaissance surveys included an initial visit on January 22, 2008 to assess vegetation communities and plant and wildlife species that potentially occur in the Project Area. Additional reconnaissance consisted of 1) siting for a meteorological station on October 9 and November 19, 2008; 2) a BLM sensitive species review on January 28, 2009 (for the western burrowing owl, Sonoran population of the desert tortoise, Le Conte's thrasher [*Toxostoma lecontei*], and Tucson shovelnose snake [*Chionactus occipitalis klauberi*]); 3) biological clearance for proposed groundwater exploration sites on March 30, 2009; 4) a reconnaissance for potentially suitable habitat for the Tucson shovelnose snake on September 9, 2009; 5) and a biological review in support of the CWA Section 404 Significant Nexus Analysis on July 29, 2009. Technical memoranda for the BLM sensitive species review and the Tucson shovelnose snake habitat survey are included in field survey documentation (Pape 2009).

3.19.4 General Wildlife

The Project Area is situated south of the Gila River, east of a major bend in the river (Map 29), between the Buckeye Hills to the north and the Maricopa Mountains to the south. It is generally level, with nominal variation in elevation within its limits. The Project Area is bounded on the south by an existing utility corridor, which separates it from the Sonoran Desert National Monument. SR-85 is approximately 4.5 miles west of the proposed power plant site. Elevations in the Project Area vary between 1,007 and 1,138 feet amsl.

Habitat for wildlife is defined by the presence or absence of a species in an area in a particular vegetation community type. Areas that appear suitable for a species but that have not been surveyed are considered possible habitat. Wildlife habitat in the Project Area corresponds with the Sonoran Creosotebush-Bursage Scrub vegetation community series, as described in Section 3.16 (Vegetation and Special-status Plant Species. There are approximately 3,620 acres of this vegetation community in the Project Area. Additional wildlife habitat in the analysis area includes the Sonoran Palo Verde-Mixed Cacti/Sonoran Creosotebush-Bursage

vegetation community series, and the high elevation Sonoran Desert mountain vegetation community, which occurs in the Buckeye Hills and the North Maricopa Mountains as described in Section 3.16 (Brown 1994).

There are no perennial or intermittent streams, washes, or wetlands in the Project Area. All washes are ephemeral and flow only after heavy rainfall events. There may be temporary puddles after storms in low depressions, but these are unlikely to last more than a few hours or a few days. There are no rocky outcrops that support tinajas (natural bedrock features that retain rainfall as pools of water) in the Project Area. Surface hydrology in the Project Area is controlled by a north-south drainage divide, which divides the Project Area roughly in half (see Map 26). Xeroriparian washes in the western portion of the Project Area drain to the Rainbow Wash, which empties into the Gila River approximately 8.5 miles to the southwest of the Project Area (approximately 5 miles downstream of the Gillespie Dam). The eastern portion of the Project Area drains into an unnamed tributary to Waterman Wash that is the complement of the Rainbow Wash, and directs Project Area waters to the Waterman Wash approximately 2.5 miles to the northeast. These washes do not support true riparian vegetation, but allow for a semi-dense growth of shrubs and bushes, which is defined as the xeroriparian vegetation.

An ephemeral CCC stock pond is located in the eastern portion of the Project Area, near Ocotillo Road (see Map 23). This stock pond supports semi-dense, brushy vegetation for most of the year. It is unknown how often wildlife use this stock pond for watering, but a network of trails leading to the pond from both the north and south are evident in fall 2005 satellite imagery, implying that wildlife use is relatively high.

Existing noises in the analysis area are generally low and are produced from localized equipment in suburban development (i.e., generators and air conditioners), sporadic traffic, and high-altitude aircraft. A complete description of existing and background noise in the analysis area can be found in Section 3.9.4 (Existing Noise Sources in the Area of Analysis).

The following sections discuss wildlife species that are either commonly found in these vegetation communities, or were observed in the Project Area during reconnaissance for this project.

3.19.4.1 MIGRATORY BIRDS, RAPTORS, AND GAME BIRDS

Most of the bird species occurring in the United States are protected under the MBTA of 1918 (amended in 1936, Mexico, and 1972, Japan). Species protected under this act include neotropical migrants and raptors. The MBTA prohibits the taking, killing, or possessing of migratory birds, unless authorized by the Secretary of the Interior. Take is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect." EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) requires the United States to oblige significant responsibility to provide for the conservation of migratory birds and their habitats, with an emphasis on species of concern. Federal agencies are also required to support the objective of the migratory bird conventions by incorporating bird conservation values, standards, and practices when engaging in activities and would attempt to minimize adverse impacts on migratory birds when conducting agency acts. Some of these species are also considered BCCs by the USFWS (2008). These species are discussed further in Section 3.19.5.

Foraging and nesting raptor populations are often surveyed for use as indicators of habitat health due to their place at the top of the food chain (Romin and Muck 2002). There is evidence that destruction and degradation of both nesting and foraging habitat can strongly alter raptor nesting success and, ultimately, affect populations (Romin and Muck 2002). Additionally, raptors can often be slow to recover from habitat degradation due to certain life history traits such as long life spans, slow reproductive rates, and specific habitat requirements (McCallum 1994, Kaufman 1996, Romin and Muck 2002). Raptors also show a high fidelity to nesting sites and territories and many species have narrow habitat requirements for nesting and nest placement. In short, raptors are especially vulnerable to habitat degradation and disturbance. Raptors, as well as their nests and eggs, are protected by the MBTA.

Much of the Sonoran Creosotebush-Bursage Scrub vegetation community in the Project Area consists of pure stands of creosotebush. There are no wildlife species that are solely dependent on creosotebush habitat (Raitt and Maze 1968; Tomoff 1974), and most birds, including raptors, use this community for cover and foraging, and not for nesting. Most of the xeroriparian washes in the analysis area provide more cover or forage for birds and other wildlife than the Sonoran Creosotebush-Bursage Scrub vegetation community. However, because of the lack of perennial water, these washes do not support the diverse species typically found in true riparian habitat. Migratory bird species that were observed in the Project Area during reconnaissance surveys are listed in Table 3.54. The Gila woodpecker (*Melanerpes uropygialis*) and loggerhead shrike (*Lanius ludovicianus*) are priority species for the LSFO. These species are discussed further in Section 3.19.5.2 (Special-status Species).

Table 3.54 Migratory Bird Species Observed in the Project Area during Reconnaissance Surveys, 2009

Common Name	Scientific Name
American kestrel	*Falco sparverius*
American pipit	*Anthus rubescens*
Ash-throated flycatcher*	*Myiarchus cinerascens*
Black-chinned hummingbird	*Archilochus alexandri*
Black-tailed gnatcatcher*	*Polioptila melanura*
Black-throated sparrow*	*Amphispiza bilineata*
Cactus wren*	*Campylorhynchus brunneicapillus*
Canyon towhee*	*Pipilo fuscus*
Gambel's quail	*Callipepla gambelii*
Gila woodpecker*	*Melanerpes uropygialis*
Horned lark	*Eremophila alpestris*
Ladder-backed woodpecker	*Picoides scalaris*
Loggerhead shrike	*Lanius ludovicianus*
Mourning dove*	*Zenaida macroura*
Northern flicker*	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Phainopepla*	*Phainopepla nitens*
Red-tailed hawk	*Buteo jamaicensis*
Rock wren	*Salpinctes obsoletus*
Say's phoebe	*Sayornis saya*
Turkey vulture	*Cathartes aura*
Verdin*	*Auriparus flaviceps*
Western burrowing owl	*Athene cunicularia*
Western meadowlark	*Sturnella neglecta*
White-crowned sparrow	*Zonotrichia leucophrys*
Yellow-rumped warbler	*Dendroica coronata*

*Denotes bird species commonly observed in the Project Area.

The AZGFD manages many bird species as game birds, three of which are also listed as priority species by the LSFO. These consist of the mourning dove, white-winged dove (*Zenaida asiatica*), and Gambel's quail. All of these species have the potential to occur in the Project Area and analysis area. Native members of the dove family (Columbidae) are covered under the MBTA, and management is cooperative between states and the USFWS. Members of the quail family (Odontophoridae) are not covered by the MBTA, and are managed by the states.

3.19.4.2 MAMMALS

3.19.4.2.1 Big Game

Big game species with the potential to occur in the Project Area and analysis area consist of bighorn sheep (*Ovis canadensis*), mule deer, mountain lion (*Puma concolor*), and javelina (*Pecari tajacu*). Populations of these species are managed for hunting by the AZGFD by establishing seasonal hunting dates and permit numbers for each species. These species are also listed as priority species by the LSFO. The Project Area falls in AZGFD Game Management Unit 39 (AZGFD 2009).

Bighorn Sheep

Bighorn sheep require access to water, suitable forage, and steep escape terrain for predator avoidance. AZGFD suspects that most of the bighorn sheep in the southwestern corner of Arizona are a single metapopulation (personal communication, Dana Warnecke 2011). This means that there are isolated small populations in pockets of habitat within the range of the larger metapopulations, and genetic mixing occurs through dispersal of individuals from one population to another. Furthermore, AZGFD transplants individuals from regions with stable and growing populations into local populations to enhance genetic mixing. It is currently unknown which routes bighorn sheep use to travel between populations both historically and currently, but it is suspected that genetic mixing occurs among the Buckeye Hills (east and west), Sierra Estrella, Maricopa, and Gila Bend mountains, as well as habitat patches located further west and north of the analysis area (personal communication, Dana Warnecke 2011). A bighorn sheep roadkill found near the proposed Project Area on Rainbow Valley Road in 1997 suggests that some movement occurs between the Buckeye Hills and North Maricopa mountains (AZGFD 2011a).

A census was completed on bighorn sheep populations in the analysis area in 2009, with the following results. Eight bighorn sheep are estimated to exist in the North Maricopa Mountains, with a total estimate of 23 bighorn sheep in the entire Maricopa range. Sixteen bighorn sheep are estimated to exist in the Sierra Estrella Mountains. The population is estimated to be 113 individuals for the Gila Bend Mountains. No bighorn sheep have been found in the Buckeye Hills since 1999. Because of this, AZGFD transplanted five bighorn sheep into the west Buckeye Hills (i.e., west of SR-85) in November 2009 to augment this population, and two more individuals were transplanted in 2010 (AZGFD 2011a).

Although bighorn sheep prefer to live in mountainous habitat, they may cross through the lowland Project Area habitat while traveling to more appropriate habitat. Wildlife linkage corridors for this species are discussed further in Section 3.19.6 (Wildlife Linkages). SR-85 in its current configuration may act as an effective barrier to bighorn movements, limiting movements of bighorn sheep between the Gila Bend Mountains and either the east Buckeye Hills or the North Maricopa Mountains.

No bighorn sheep have been detected in the east Buckeye Hills in recent years (Henry 2009). The apparent absence of bighorn sheep in the east Buckeye Hills may be due to inadequate resources (e.g., water) to independently support them. Historic use of the east Buckeye Hills by bighorns may have been dependent on access to the Gila Bend Mountains prior to the movement-inhibiting impacts of SR-85 in its current multilane configuration. No bighorn sheep or their sign have been observed during any site reconnaissance surveys or other Project Area visits.

Mule Deer

Mule deer inhabit a wide range of elevations and habitats, often preferring areas that provide a balance of both cover and visibility. They require cover and suitable forage, which typically includes a variety of subshrubs, shrubs, and tree species. The mule deer populations in Arizona are not declining and are considered secure. The presence and activity of mule deer in the analysis area may occur throughout the Sonoran Creosotebush-Bursage Scrub habitat of the analysis area, and is also associated with Xeroriparian Wash habitat such as the Rainbow Wash and the unnamed tributary to Waterman Wash. Xeroriparian Wash habitat would be used by the species for movement through the valley. Mule deer have also been documented using stock tanks as a water source, and may use the CCC stock tank when water is present. No mule deer or their sign have been observed in the Project Area. Wildlife linkage corridors for this species are discussed further in Section 3.19.6 (Wildlife Linkages).

Mountain Lion

Mountain lions inhabit a wide elevation range and typically occur in habitats that support their primary prey (i.e., deer), or other prey species, including javelina, jackrabbits, rodents, and occasionally cattle or bighorn sheep (Hoffmeister 1986; Valdez and Krausman1999). Their numbers in the analysis area are likely low, and their presence in the analysis area would be most likely in the mountains north or south of the Project Area. Mountain lions may be present throughout the Project Area. Xeroriparian Wash habitat would likely be used by individuals' movements between mountain ranges, or along major valley washes in pursuit of prey. See Section 3.19.6, below, for further discussion on wildlife linkage corridors.

Javelina

Javelina are primarily residents of lower elevation desertscrub habitat, but will range up to juniper, and occasionally lower oak elevations (Hoffmeister 1986). They usually inhabit areas of dense scrub that includes prickly pear cacti (*Opuntia* spp.), which is their primary source of food. Javelina are likely to occur in the Project Area in small numbers. Although they may be present in the Project Area, they would most likely use the Xeroriparian Wash habitat.

3.19.4.2.2 Predators, Furbearers, and Small Game

Predatory, furbearing, and small game species populations are monitored and managed for hunting by the AZGFD by setting seasonal hunting dates, bag limits, and regulated practices for predator control. Predatory species with the potential to occur in the analysis area consist of bobcat (*Lynx rufus*), kit fox, gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), American hog-nosed skunk (*Conepatus leuconotus*), western spotted skunk (*Spilogale gracilis*), and hooded skunk (*Mephitis macroura*). Furbearers with the potential to occur in the analysis area consist of ringtail (*Bassariscus astutus*), raccoon (*Procyon lotor*), and badger. Small game with the potential to occur in the analysis area consists of the desert cottontail (*Sylvilagus audubonii*). Black-tailed jackrabbit (*Lepus californicus*) also occur in the analysis area. Evidence of kit fox and coyote were observed on the Project Area during reconnaissance surveys in 2009.

3.19.4.2.3 Small Mammals

Small mammal populations are not monitored by the AZGFD or the BLM LSFO; however, they are often used as an indicator for habitat health because of the importance of small mammal populations as a prey base for other species, such as raptors, predatory mammals, and snakes. For this reason, some small-mammal species are listed as priority species by the LSFO. Small mammals with the potential to occur in the Project Area and analysis area consist of desert pocket mouse (*Chaetodipus penicillatus*), rock pocket mouse (*Chaetodipus intermedius*), Arizona pocket mouse (*Perognathus amplus*), woodrat (*Neotoma* sp.),

kangaroo rat (*Dipodomys* sp.), American deer mouse (*Peromyscus maniculatus*), and southern grasshopper mouse (*Onychomys torridus*). Round-tailed ground squirrels (*Spermophilius tereticaudus*) as well as pocket mouse burrows and woodrat middens were observed on the Project Area during site reconnaissance surveys in 2009.

3.19.4.3 REPTILES AND AMPHIBIANS

All reptile and amphibian species with potential to occur in the Project Area are managed by the AZGFD as nongame species, and may be taken, with the exception of the Gila monster (*Heloderma suspectum*) and the Sonoran desert tortoise.

Reptile species observed in the Project Area during site reconnaissance surveys in 2009 consisted of common side-blotched lizard (*Uta stansburiana*), western whiptail lizard (*Aspidoscelis tigris*), desert iguana (*Dipsosaurus dorsalis*), long-tailed brush lizard (*Urosaurus graciosus*), and sidewinder (*Crotalus cerastes*). The zebra-tailed lizard (*Callisaurus draconoides*) has also been observed in the analysis area.

The potential for the desert tortoise to occur in the analysis area is discussed further in Section 3.19.5. The Gila monster is discussed in Section 3.19.6 (Wildlife Linkages).

The only amphibian breeding habitat in the Project Area is located at the CCC stock pond. The waters of this pond are ephemeral, therefore only species adapted to breeding in temporary pools may be found there. The AZGFD has observed Sonoran desert toad (*Bufo alvarius*) sign and tadpoles in ephemeral stock tanks in the analysis area, and suspects that this species also breeds in the CCC stock pond. Other species with potential to breed in the CCC stock pond include the southern spadefoot (*Scaphiopus multiplicatus*) and Great Plains toad (*Bufo cognatus*).

3.19.5 Threatened, Endangered, and Special-status Species

Threatened, endangered, and special-status wildlife species that were reviewed for the potential to occur in the Project Area are listed in Appendix E. Only species with the potential to occur in the Project Area are further discussed in this document. Table 3.55 lists these species, their conservation status, and their potential to occur in the Project Area.

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Birds					
Ferruginous hawk	*Buteo regalis*	WSC BCC	Open grasslands, prairies, and desertscrub	No	Moderate
Golden eagle	*Aquila chrysaetos*	BGEPA	Nest on cliffs, trees, or artificial structures. Diverse foraging habitat	No	Very low; foraging only
Peregrine falcon	*Falco peregrinus anatum*	BLMS WSC BCC	Open habitats in rugged country, usually near lakes, rivers, or streams and with rocky outcrops or cliffs nearby	No	Low
Western burrowing owl	*Athene cunicularia hypugaea*	BLMS BCC	Open areas of low slope where low vegetation provides good visibility. Usually associated with colonial burrowing rodents	Yes	Present

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Elf owl	*Micrathene whitneyi*	BCC	Nests in tree holes and columnar cacti in desert into middle-elevation woodlands	No	Moderate
Costa's hummingbird	*Calypte costae*	BCC	Desertscrub, thorn scrub, and other arid brushy areas	No	High
Gila woodpecker	*Melanerpes uropygialis*	BCC	Sonoran desertscrub and riparian woodlands	Yes	High
Gilded flicker	*Colaptes chrysoides*	BCC	Low-elevation Sonoran desertscrub with saguaros present for nest cavities	No	High
Loggerhead shrike	*Lanius ludovicianus*	BLMS BCC	Open, brushy areas with scattered trees used for hunting patches	Yes	High
Crissal thrasher	*Toxostoma crissale*	BCC	Dense vegetation associated with desert washes	No	Very low
Le Conte's thrasher	*Toxostoma lecontei*	BCC	Very low, hot, open desertscrub with scattered bushes or cholla	No	Moderate
Lucy's warbler	*Vermivora luciae*	BCC	Brushy washes and riparian areas within desertscrub	No	Moderate
Chestnut-collared longspur	*Calcaruis ornatus*	BCC	Winters in the southwest in grassland and desert habitats	No	Low
Lawrence's goldfinch	*Carduekus lawrencei*	BCC	Winters in open, brushy deserts and grasslands	No	Moderate
Mammals					
California leaf-nosed bat	*Macrotus californicus*	BLMS WSC	Desertscrub with caves or mines for colonies	No	Foraging only
Cave myotis	*Myotis velifer*	BLMS	Roosts in colonies in mines and caves at lower elevations within a couple miles of water	No	Foraging only
Western red bat	*Lasiurus blossevillii*	BLMS WSC	Riparian or desert shrub habitat at various elevations; roosts in large trees	No	Foraging only
Southern yellow bat	*Lasiurus ega*	BLMS WSC	Primarily associated with its preferred roost the desert fan palm at natural oases or in landscape situations; often near water; other records in Arizona and New Mexico from broad-leaf riparian habitats	No	Foraging only
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	BLMS	Low desert habitats with rocky cliffs that provide roosting habitat for small colonies; human structures	No	Foraging only
Greater mastiff bat	*Eumops perotis californicus*	BLMS	Roost in groups in crevices and shallow caves on the sides of cliffs and high rock walls	No	Foraging only
Spotted bat	*Euderma maculatum*	BLMS WSC	Roosts in crevices and caves in rocky cliffs from below sea level to pine forests	No	Foraging only

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Amphibians					
Great plains toad	*Bufo cognatus*	BLMS	Inhabits flats and low valleys from Lower Colorado Subdivision Sonoran Desert up to grassland elevations	No	Moderate
Reptiles					
Sonoran desert tortoise	*Gopherus morafkai (formerly G. agassizii)*	C WSC	Rocky foothills in desertscrub and Semi-desert Grassland habitats	No	Very low

*** Status Acronym Legend:**
C = Federal Candidate for listing under the ESA.
BCC = Birds of Conservation Concern.
BLMS = BLM Sensitive Species.
WSC = Wildlife of Special Concern.
BGEPA = Protected under Bald and Golden Eagle Protection Act.

3.19.5.1 FEDERALLY LISTED (ESA) SPECIES

The only federally listed, candidate, or proposed wildlife species that is likely to occur in the Project Area is the Sonoran desert tortoise (*Gopherus morafkai*; candidate). There is no designated critical habitat for any federal wildlife species in the Project Area. The BLM has initiated informal consultation with the USFWS for the SSEP. A BA has been prepared for the SSEP and has determined that there would be no project-related effects to any federally listed species and/or their designated critical habitat. The USFWS has provided concurrence for this determination (USFWS 2010). When the BA was completed in 2009, the Sonoran desert tortoise was undergoing a 12-month review to determine whether listing was warranted; therefore, the effects of the project were not determined for this species in the BA. The review was completed in December 2011 and found that the Sonoran desert tortoise species warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010).

Sonoran Desert Tortoise

The Sonoran desert tortoise was recently described as a species distinct from the Mojave desert tortoise (*G. agassizii*) (Murphy et. al 2011). Until this description was published, the Sonoran and Mojave desert tortoises were considered to be distinct population segments of the same species. For the purposes of this analysis, this species is considered to be distinct; however, note that many referenced documents (including USFWS publications) refer to the Sonoran population of the species. A 12-month review was completed by the USFWS in December 2011 and found that the Sonoran desert tortoise warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010). The Sonoran desert tortoise is also given special attention by most agencies due to its similarity in appearance to the threatened Mohave population of the same species. It is considered a sensitive species by the BLM Arizona State Office and a WSC by the AZGFD (AZGFD 2009a).

The Sonoran desert tortoise is found in southern and western Arizona, south and east of the Colorado River, and is also found across the border in much of western Sonora, Mexico (AZGFD 2001a). Sonoran desert tortoises may be found in Mohave and Sonoran desertscrub vegetation communities. They may be found in palo verde and saguaro communities in the Sonoran Desert (Lawler 2009). These tortoises prefer rocky slopes

and bajadas at the base of desert mountain ranges (AZGFD 2001a). They may be found at elevations between approximately 510 feet in Mohave desertscrub and 5,300 feet in semi-desert grassland and interior chaparral (AZGFD 2001a). Sonoran desert tortoises are primarily herbivores, consuming a wide variety of plant materials. They are known to feed on flowering annuals, grasses, leafy perennials, trees and shrubs, subshrubs and woody vines, and succulents (AZGFD 2001a). They also ingest rocks, bones, and soil, possibly to maintain intestinal bacteria, to provide additional minerals, or as gastroliths to aid digestion (Ivanyi et al. 2000; Lawler 2009).

This species has one clutch of eggs per season. Hatchling and juvenile mortalities are very high, and it has been estimated that only one hatchling for every 15 to 20 nests will survive to reach sexual maturity (Lawler 2009). Sonoran desert tortoises face numerous threats to their survival. Livestock grazing, recreational OHV use, military training activities, urban development, road construction, agriculture, and mineral development are all factors that can alter or destroy their habitat (Lovich 1999). An increase in common predators, such as the common raven (*Corvus corax*), coyote, and domestic dog, may increase the mortality of hatchlings and juvenile tortoises (Boarman 2002). Sonoran desert tortoises will urinate in response to harassment, which is especially harmful because of the limited water resources in their habitat and the inability to easily replenish lost water. Decreasing numbers of Sonoran desert tortoises are often the result of illegal removal of adult tortoises (for pets or commercial sale), vehicle mortality (Lovich 1999), vandalism (shooting, crushing, or mutilation) (Berry 1986; Howland and Rorabaugh 2002), and the use of them as a food source (USFWS 1994).

Invasion by exotic plants can have a significant, negative impact on tortoises due to resultant changes in the native vegetation community. Red brome, a European import, competes with native perennial grasses, shrubs, and annuals. This weed species has a high potential to invade the Project Area and analysis area. Red brome is highly flammable and promotes wildfires in desert vegetation communities; recurrent fires directly increase tortoise mortality and reduce the abundance and diversity of native forbs on which they depend (National Park Service 2001).

Three categories of desert tortoise habitat are designated by the BLM: Categories I, II, and III. Category I habitat is intended to maintain stable, viable populations of the tortoise, protect existing tortoise habitat, and increase populations where possible. Category II habitat should maintain stable, viable populations and halt further tortoise declines. Category III habitat should limit tortoise habitat and population declines to the extent possible by mitigating impacts. Category I, II, and III habitats exist in the analysis area. Category I habitat is designated 0.65 mile south of the Project Area in the North Maricopa Mountains. Category II habitat is designated in the west Buckeye Hills, 1.3 miles northwest of the Project Area, Category III habitat is designated in the eastern Buckeye Hills, 1.15 miles north of the Project Area (see Map 29). The Project Area does not include any designated tortoise habitat.

BLM tortoise habitat is delineated along the base of the Buckeye Hills and the North Maricopa Mountains, incorporating the foothill areas, but not containing substantial portions of the upper bajada below the mountain pediment. Sonoran desert tortoises typically inhabit foothills and upper bajada slopes associated with desert mountain ranges, and are much less common in the lower portions of interior valleys (Averill-Murray and Averill-Murray 2005), which is where the Project Area is located. Although tortoises have the potential to occur anywhere in the Project Area and lowland valleys while in transit between suitable habitat patches such as the surrounding mountains, any use of the Project Area as habitat for residency, foraging, or reproduction is not anticipated. Linkages between these foothill habitats are discussed in further detail in Section 3.19.6.

During site reconnaissance surveys in 2009, Sonoran desert tortoises or their sign were not found in the Project Area or analysis area (Pape 2009). A lack of tortoise sign in the area indicates that local populations of the desert tortoise may be low. Additionally, although tortoises have been observed traveling across desert valleys, dispersal rates have been low (Edwards et al. 2004). The combination of low local population levels and low natural dispersal suggests a very low probability of tortoises using the Little Rainbow Valley over the project lifetime.

3.19.5.2 SPECIAL-STATUS SPECIES

Special-status wildlife species are those that are recognized by various agencies as being in need of protection and/or management due to significant reductions in species populations, contractions of their total range, or other aggravating factors that may ultimately place the continued existence of the species in jeopardy. These species are listed by the AZGFD as wildlife of Special Concern (WSC), by the BLM as sensitive species, and/or by the USFWS as BCC. These species are often given legal protection under applicable laws.

3.19.5.2.1 Special-status Birds

Ferruginous Hawk

The ferruginous hawk is a BLM sensitive species and an AZGFD WSC (AZGFD 2009a). It occurs throughout the western Great Plains, Intermountain West, and California's Central Valley (Sibley 2000). It is an arid land specialist, and occurs in habitats such as shortgrass prairie, sagebrush, semi-desert grassland, and open desertscrub. This species is migratory, breeding in parts of the Great Basin and Great Plains, and winters primarily in low elevation grasslands and deserts in the United States and into northern Mexico. The most important prey species for the ferruginous hawk are small mammals, including rabbits, ground squirrels, and prairie dogs. Hunting is done from either perches or in flight. Ferruginous hawks are the largest species of Buteo in North America, and build nests in trees or power poles present in open habitat (Woffinden and Murphy 1983).

Populations of this species have declined in Arizona over the past decade (AZGFD 2001a). In some cases, loss of habitat appears to be a threat to the species. Land manipulation through development, conversion to agriculture, and grazing may all have negative effects. Invasive plant species may also be an indirect factor in population declines due to reductions in prey populations (Woffinden and Murphy 1989). Disturbance of nests may result in abandonment or decreased reproductive success (White and Thurow 1985). The valley and agricultural habitats of the analysis area are suitable winter foraging habitat for ferruginous hawks (Wheeler 2003).

The Project Area and analysis area are suitable winter foraging habitat for ferruginous hawks. It is likely, though, that suitable winter foraging habitats is not abundant in these areas. This is because in Arizona, this species most often winters in semi-desert grasslands, and not in the Lower Colorado desert, which is where the Project Area is located (Wheeler 2003). Furthermore, this species often winters near colonies of prairie dogs or pocket gophers (Bechard and Schmutz 1995), neither of which occurs in abundance in the Project Area.

Golden Eagle

The golden eagle ranges throughout western North America in open, mountainous county. They are widely distributed throughout the state of Arizona. The breeding season occurs from late February to March. In southern Arizona, nests are primarily constructed on cliffs and secondarily constructed on artificial structures and trees. The species is sensitive to disturbance to its nesting area; nests are usually a

minimum of 0.5 mile apart, and average territory size is approximately 20–55 square miles (NatureServe 2010). The species primarily eats rabbits, marmots, and ground squirrels, but may also eat insects, snakes, birds, juvenile ungulates, and carrion (NatureServe 2010). It typically forages in open areas and habitats where prey species occur.

A survey of golden eagle nest locations in areas surrounding and including the Project Area (excluding the Sierra Estrella Mountains) was conducted by AZGFD in 2011 (personal communication, Kevin Grove 2011). The results of this survey found no nests resembling golden eagle nests within a 10-mile radius of the Project Area. The nearest known golden eagle territory is located over 69 miles from the Project Area (AZGFD 2011b). The habitat potential of the surrounding area for golden eagle nesting is negligible, given a lack of cliff habitat in the analysis area.

The Project Area has the potential to be used by golden eagles as foraging habitat, but there is no known or documented use of the area. During the 2011 AZGFD survey, the nearest golden eagle sighting was 45 miles from the Project Area. Due to the lack of suitable nesting habitat within a typical 10-mile nesting range of the Project Area, foraging use would most likely be limited to migratory and nonbreeding golden eagles.

Peregrine Falcon

The peregrine falcon is a BLM sensitive species and an AZGFD WSC (AZGFD 2009a). This species was federally listed as endangered in October 1970, and it was delisted in August 1999 after showing significant recovery (USFWS 2009). The peregrine falcon has a nearly global distribution and ranges from tropical habitats to tundra (White et al. 2002). Peregrine falcons inhabit open country where prey is abundant (Ehrlich et al. 1988; Glinski 1998). Their diet primarily includes birds, particularly rock pigeons (Columba livia), but also many aquatic bird species, game birds, passerines, rodents, bats, and occasionally flying insects (Glinski 1998; Terres 1980; White et al. 2002). Peregrine falcons hunt in flight, often as a pair (Glinski 1998). They do not construct their own nests, but modify old nests of raptors and corvids. In Arizona, nests are primarily on cliff ledges; elsewhere, peregrine falcons nest in trees (Glinski 1998; Terres 1980).

Historically, the primary threat to peregrine falcons has been from pesticides that accumulate in the birds. Pesticides also cause egg shell thinning, which results in nest failure (AZGFD 2002). In addition, people rock climbing near nests can disturb peregrine falcons.

Peregrine falcons are likely to forage in the winter along the Gila River and prey on larger bird species such as waterfowl, shore, and wading birds (Glinski 1998; Wheeler 2003). There is a potential for falcons to forage over any part of the Project and analysis areas; however, prey would be limited to native doves, passerine bird species, and bats (Glinski 1998; Wheeler 2003). Peregrine falcons may occur in the Project Area, but are expected to occur very infrequently because preferred, large avian prey is uncommon in the dominant Sonoran Creosotebush-Bursage Scrub vegetation community.

Western Burrowing Owl

The western burrowing owl is considered a BLM sensitive species (AZGFD 2009a). This species breeds in North America from southern Alberta, Saskatchewan, and Manitoba, south to Baja California and central Mexico, and east to western Minnesota, western Kansas, and western Texas (American Ornithologists' Union 1998). Western burrowing owls can be found in suitable habitat throughout Arizona (deVos 1998), which is an important wintering area in the United States (NatureServe 2009).

Western burrowing owls inhabit open areas in deserts, grasslands, and agricultural and range lands. They use well-drained areas with gentle slopes and sparse vegetation, and may occupy areas near human habitation, such as golf courses and airports (Dechant et al. 2003; Ehrlich et al. 1988; Terres 1980). Western

burrowing owls often select burrows where surrounding vegetation is kept short by grazing, dry conditions, or burning (Hjertaas et al. 1995; Dechant et al. 2003). In Arizona, western burrowing owls prefer grasslands, Creosotebush-Bursage Scrub communities, and agricultural lands (deVos 1998).

Western burrowing owls are semicolonial and usually occupy burrows excavated by small mammals, often at the edges of active colonies of prairie dogs (*Cynomys* spp.) or ground squirrels (*Spermophilus* spp.). In areas that lack colonial burrowing mammals, western burrowing owls use excavations made by other mammals such as badgers, woodchucks (*Marmota monax*), skunks, foxes, armadillos (*Dasypus novemcinctus*), and coyotes. In addition to the nest burrow, these owls may also use several satellite burrows. Satellite burrows may serve as protection from predators and parasites (Dechant et al. 2003). Occasionally they may excavate their own burrows.

Western burrowing owls are opportunistic feeders, preying on a variety of arthropods and small vertebrates (Dechant et al. 2003; Hjertaas et al. 1995). They may forage during the day or night, but tend to forage closer to the nest during the day. Foraging habitat is variable, depending on prey availability and abundance. In the southern portions of their range (primarily Arizona and southern California), western burrowing owls are mostly nonmigratory (AZGFD 2001b; Haug et al. 1993).

The single greatest range-wide cause of burrowing owl declines is the reduction in populations of burrowing mammals through control programs, an activity frequently coupled with conversion of grassland habitat to agriculture or pasture (Klute et al. 2003). Widespread declines in the range and abundance of western burrowing owls have also been attributed to habitat loss and fragmentation. Additionally, the control and extermination of colonial burrowing mammals has also led to declines, because burrowing animals are not present to create suitable nesting habitat (Dechant et al. 2003; Hjertaas et al. 1995).

Potential nesting habitat for western burrowing owls has also been reduced throughout their range by converting land to agricultural and urban uses (Hjertaas et al. 1995). In addition to removing potential nest sites, habitat fragmentation may increase the density of predators such as foxes and coyotes and may make it more difficult for unpaired burrowing owls to find mates (NatureServe 2009). Increased urbanization may increase their predation by domestic dogs and cats. Pesticides may harm burrowing owls through direct toxicity, secondary toxicity from ingesting poisoned prey, and from a reduction in the abundance of prey due to pesticide toxicity (Dechant et al. 2003).

During site reconnaissance surveys in 2009, two western burrowing owls and sign in the form of scat, pellets, and burrows, were observed in the Project Area (Pape 2009). A reconnaissance-level survey was conducted again in 2011 to determine burrowing owl presence/absence and the status of the species in the Project Area. During the two surveys, a total of six burrowing owl individuals, 17 burrows, and sign[5] were found throughout the Project Area.

Because western burrowing owls require good visibility close to their nests for hunting and predator avoidance (deVos in: Glinski 1998; McDonald et al. 2004), the creosotebushes in many sections of the Project Area and analysis area are too dense for western burrowing owl habitat. The location of burrowing owls is likely dependent on the abundance of their prey (small mammals, amphibians, reptiles, insects, and/or birds) in proximity to the CCC stock tank as well as other ephemeral water sources. The burrows that were found during field reconnaissance are located within creosotebush habitat that is nearly identical to the creosotebush habitat further west in the Project Area. It is likely that the number of burrowing owls that use the Project Area is higher than the numbers found in the 2009 and 2011 field surveys.

[5] The presence of sign suggests that this species is breeding in the Project Area.

Loggerhead Shrike

The loggerhead shrike can be found in open country with scattered trees and shrubs, savanna, desertscrub, and occasionally open woodland. It is often found on poles, wires, fence posts, or on trees. This species usually nests in trees, but can be found in shrubby and tree-less habitats in the winter. A loggerhead shrike was seen in the Project Area during site reconnaissance in the fall of 2009. Individuals of this species would most likely be present in the Project Area during nonbreeding months.

3.19.5.2.2 Birds of Conservation Concern

USFWS BCC that have the potential to occur in the Project Area and analysis areas are listed in Table 3.55. These species have been identified by the USFWS as species that may become candidates for listing under the ESA if additional conservation actions are not carried out (USFWS 2008). BCC are protected under the MBTA, described above.

3.19.5.2.3 Special-status Bats

Table 3.55 includes seven species of bats that may occur in the Project Area and analysis area. As foraging habitat requirements and potential for occurrence in the area are similar for all bat species listed, they are discussed here as a group.

Roost habitat can be a primary determinant for the local presence of most bat species in their overall range. Roosts vary across species, but include large trees, caves, and rock crevices as natural roosts and buildings, bridges, and mines as frequently used human-made roosts. Bats may hibernate in winter, go into short-term torpor, or may be migratory.

All bat species with potential to occur in the analysis area are insect eaters. Most detect prey through echolocation while flying (AZGFD 2009a). Most desert bat species require a water source in their foraging range, both for drinking and as a source of flying insects. Threats are similar for all bat species discussed here. Roost habitat loss and human disturbance of roosting bats are generally the greatest threats, although pesticide accumulation in or near agricultural areas (Clark 1988) and habitat degradation that reduces drinking water locations and prey populations can also affect bats.

No suitable roosting habitat for any bat species occurs in the Project Area, because no rocky habitat, mines, caves, or large trees are present. The greatest food sources for foraging bats in the analysis area are located near water such as the CCC stock pond, Gila River, or near agricultural fields east of the project.

3.19.5.2.4 Special-status Amphibians

Great Plains Toad

In Arizona, the Great Plains toad is widespread, except for in the higher mountains and lowest and driest portions of the Sonoran Desert. This species is found primarily in valleys, mesas, and flats characterized by Sonoran, Chihuahuan, or Great Basin desertscrub; grasslands; and sparingly into montane woodlands. In these areas, this species can often be found in cattle tanks, roadside ditches, and canals in agricultural areas, and in the floodplains of rivers and streams, ciénegas, and other wetland types (Arizona Partners in Amphibian and Reptile Conservation 2008).

In the Project Area, this species would most likely be found in the CCC stock pond when water is present. The Great Plains toad has been found in the Vekol Valley, which is approximately 15 miles to the southeast of the Project Area (Enderson and Bezy 2005).

3.19.6 Wildlife Linkages

A wildlife linkage is a continuous swath of land in the natural landscape that provides suitable habitat for short-and/or long-term movements of wildlife and plants between population cores. Additionally, such linkages provide flexibility of movement for populations in larger areas of suitable habitat in response to changes in the local environment or natural chance or catastrophic events. Linkages may also serve as refugia for subsequent recolonization of adjacent disturbed habitats (Beier and Loe 1992). A collaborative effort between ADOT, AZGFD, and other agencies initiated a statewide project in 2004 to delineate areas with potential value as wildlife linkages. Preliminary results were released in 2006, with over 150 linkage zones described (Nordhaugen et al. 2006).

A 2008 wildlife linkage study (Beier et al. 2008) analyzed potential wildlife habitat linkages on BLM land between wildland blocks in the Gila Bend, Sierra Estrella, and North Maricopa Mountains. The study used a species-level (focal species) approach, which means certain species were selected and information was attained to better predict the movements of these selected wildlife species through an area. The focal species were selected because they have ecological needs that represent a suite of other species. Species' characteristics that were identified for focal species selection include habitat specialists; species sensitive to human-caused barriers; species that require well connected landscapes; ecologically important species; and rare species. For example, the modeled movement for a focal species such as a bobcat would represent probable movement for other mid-level predators and their prey. Also, the modeled movement for a focal species such as the bighorn sheep would represent probable movement for other species that require large blocks of habitat and are susceptible to habitat fragmentation due to human-caused barriers.

Other goals of establishing the linkage included 1) providing areas adequate to support long-term movements between metapopulations of less mobile species (e.g., Gila monster and desert tortoise); 2) protecting aquatic resources from pollutants; 3) allowing for movements of species over time in response to climate change; and 4) acting as a buffer against edge effects, including invasive species, noise, pets, and others (Beier et al. 2008). Edge effects may be naturally occurring or human induced, and may adversely impact the quality of wildlife habitat in areas where they occur. Changes can include permanent alteration of landscapes, such as encroachment by invasive plant species, persistent effects such as the presence of feral cats or dogs, or one-time events. Edge effects have been recognized as significant in terrestrial ecosystems up to 300 m (Beier et al. 2008).

The AZGFD, in collaboration with Northern Arizona University, released the report for the Gila Bend-Sierra Estrella Linkage (Beier et al. 2008). Subsequently, the AZGFD proposed an additional linkage, the Buckeye Hills-Sonoran Desert National Monument linkage, in the analysis area (see Map 29). The purpose of this linkage is to connect habitat blocks within the Buckeye Hills, Maricopa Mountains, Gila River corridor, and State Wildlife Areas (Robins/Powers Butte and Arlington). The Buckeye Hills-Sonoran Desert National Monument linkage is an important component of AZGFD's regional linkage plan because it provides a second linkage between the Gila River corridor and state wildlife areas (Robins/Powers Butte and Arlington), the first being the Gila Bend-Sonoran Desert National Monument linkage. To develop these linkages, AZGFD used the modeling technique and tools used by Beier et al. 2008. Although the final report (with model parameters) has not been released for the Buckeye Hills-Sonoran Desert National Monument linkage, in most cases where species were modeled for both linkages, parameters are identical to the published report on the Gila Bend-Sierra Estrella linkage.

As proposed, the Project Area overlaps 1,204 acres of the Buckeye Hills-Sonoran Desert National Monument linkage. The Gila Bend-Sierra Estrella Linkage is broken into two distinct pieces: Gila Bend-Sonoran Desert National Monument, and Sonoran Desert National Monument-Sierra Estrella. The Project Area overlaps 18.8 acres with the Gila Bend-Sonoran Desert National Monument linkage. The Sonoran Desert National Monument-Sierra Estrella Linkage is not located in the analysis area and is not discussed further in this document.

3.19.6.1 GILA BEND-SONORAN DESERT NATIONAL MONUMENT LINKAGE

The Gila Bend-Sonoran Desert National Monument linkage encompasses approximately 47,000 acres and extends approximately 3 miles into the Sonoran Desert National Monument. Focal species used for the development of this model consist of bighorn sheep, mule deer, mountain lion, bobcat, javelina, Sonoran desert tortoise, and Gila monster (Beier et al. 2008). The Gila Bend-Sonoran Desert National Monument linkage is the only wildlife corridor between the monument and the Gila River that avoids existing suburban development (Beier et al. 2008).

3.19.6.2 PROPOSED BUCKEYE HILLS-SONORAN DESERT NATIONAL MONUMENT LINKAGE

The Buckeye Hills-Sonoran Desert National Monument linkage is approximately 1.4 miles east of SR-85. This linkage encompasses 17,663 acres of land extending from the southern reaches of the eastern Buckeye Hills to the northernmost boundary of the Sonoran Desert National Monument. The area immediately adjacent to SR-85 was not included in the linkage due to the disruptive effects of the highway. A small corridor approximately 1 mile wide extends southeast approximately 3 miles into the Sonoran Desert National Monument. During development of this linkage, it was assumed that the area enclosed by this linkage was relatively equal in habitat quality throughout. All criteria used in development of this linkage were identical to those used by Beier (2008).

Focal species used for the development of this model consist of bighorn sheep, mule deer, badger, kit fox, Sonoran desert tortoise, Gila monster, Tucson shovelnose snake, and Sonoran desert toad (personal communication, Ginger Ritter 2010; AZGFD 2009b). As mentioned above, the report documenting the importance of this linkage has not been released to date. The focal species used for the development of this linkage are described below, along with the known use of each species in the Project Area.

3.19.6.3 WILDLIFE LINKAGE VALUES IN THE PROJECT AREA

The following discussion applies to wildlife species that were used as focal species in developing the linkage models discussed above. Discussion of wildlife linkage values in the Project Area addresses the currently known presence or absence of each focal species in the linkages and Project Area, and the level (robustness) of species' presence. The discussion below divides the focal species into two groups: highly mobile species and less mobile species. Beier et al. (2008; pp 21 and 64) refers to these groups as "species that need the corridor (highly mobile species), and "species the corridor needs" (less mobile species). For both groups, linkages provide important routes of connectivity for gene flow; however, what separates these groups is the time scale during which this gene flow occurs.

Highly mobile species move long distances to access suitable breeding or foraging sites. Focal species of this type consist of bighorn sheep, mule deer, mountain lion, bobcat, and desert tortoise. Individuals of these species need corridors that link large blocks of habitat, and individuals may travel these linkages in a single season. Some species, such as mountain lion and bighorn sheep, may take a few days to travel through this habitat to reach more suitable habitat. Other species, such as the desert tortoise, may take weeks to get across the linkage into more suitable habitat.

These linkages have the potential to encompass breeding habitat and entire populations of less mobile species, which are often habitat specialists. Less mobile species are those that stay within limited home ranges for the entirety of their lives. Focal species of this type consist of the badger, kit fox, javelina, Gila monster, Sonoran Desert toad, and Tucson shovelnose snake. Although some of these species may not occur in the wildland blocks for which the linkage was designed, they are important to the functioning of an ecosystem within the linkage. Managing for these species ensures that linkages are managed as a

fully-functioning ecosystem. For these species, linkages are an important route for genetic flow in the long term, a time period that can span multiple generations. Linkages are also important for less mobile species to allow populations to shift their range in response to climate change, and to allow for recolonization after fire or epidemics (Beier et al. 2008).

3.19.6.3.1 Highly Mobile Species

Bighorn Sheep

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Bighorn sheep require access to water, suitable forage, and steep escape terrain for predator avoidance. The description of the status of bighorn sheep in the analysis area can be found in Section 3.19.4.2.1 (Big Game).

The apparent absence of bighorn sheep in the east Buckeye Hills may be due to inadequate resources (e.g., water) to independently support them. Historic use of the east Buckeye Hills by bighorns may have been dependent on access to the Gila Bend Mountains prior to the movement-inhibiting impacts of SR-85 in its current multilane configuration. No bighorn sheep or their sign have been observed during any site reconnaissance surveys or other project site visits.

According to Beier et al. (2008a), the portion of the Project Area analyzed for the Gila Bend-Sonoran Desert National Monument linkage would be "strongly avoided" by bighorn sheep. It is suggested that the Project Area may be used for occasional travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (state wildlife areas), and the Sonoran Desert National Monument.

Mule Deer

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Mule deer inhabit a wide range of elevations and habitats, often preferring areas that provide a balance of both cover and visibility. They require cover and suitable forage, which typically includes a variety of subshrubs, shrubs, and tree species. Adult mule deer are known to disperse long distances, between 97 and 217 km (Anderson and Wallmo 1984 as cited in Beier et al. 2008). According to Beier et al. (2008), land cover is the most important influence over mule deer distribution, and was weighted at 80% of the model. The Rainbow Wash and the unnamed tributary to Waterman Wash would often be used for movements by the species through the valley. However, all habitat within this linkage would likely be used by mule deer to some degree. Although no mule deer or their sign have been observed in the Project Area, it is known that they use the Gila River corridor and other nearby AZGFD-managed lands extensively.

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "occasionally used" by mule deer (Beier et al. 2008), suggesting that the Project Area may be used for travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (State Wildlife Areas), and the Sonoran Desert National Monument.

Mountain Lion

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. Mountain lions require large tracts of habitat to maintain viable sustainable populations. One study in New Mexico found that annual home range size averaged 193.4 km^2 for males and 69.9 km^2 for females (Logan and Sweanor 2001 as cited in Beier et al. 2008). Dispersal rates varied from an average of 102.6 km for males and 34.6 km for females. According to Beier et al. (2008a), land cover was weighted as the most important factor influencing mountain lion dispersal patterns (70%), with the distance from roads weighted at 20%.

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be occasionally used by mountain lion, suggesting that the Project Area may be used for occasional travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (state wildlife areas), and the Sonoran Desert National Monument.

Bobcat

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. In Arizona, it is found in a range of habitats, including open deserts, juniper woodland, and in most desert mountain ranges (Beier et al. 2008). Home ranges for this species range from 2 km^2 to over 50 km^2. Dispersal distances for young bobcats average 25 km. According to Beier et al. (2008a) land cover was strongly weighted as the most important factor influencing dispersal patterns (95%).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" by bobcat. This species has such broad habitat requirements that most of the area analyzed by Beier et al (2008a) was found to be "suboptimal but used" core habitat.

Desert Tortoise

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. A 12-month review was completed by the USFWS in December 2011 and found that the Sonoran desert tortoise warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010). See Section 3.19.5.2.4 for a description of BLM-determined habitat for this species in the analysis area and a description of desert tortoise natural history and ecological needs.

No tortoises or their sign were observed during biological reconnaissance surveys and other site visits conducted in the Project Area and analysis area. A total lack of observed tortoise sign indicates that local populations may be low. These observations are supported by observed declines in the Maricopa Mountain population of nearly 90% beginning in 1987 (Western Watersheds Project 2008). There is no suitable habitat for resident tortoises in the Project Area, and tortoises would occur in the Project Area only as infrequent individuals dispersing from the adjacent mountains.

Tortoise home range size estimates range from 7 to 23 ha (approximately 17 to 57 acres); however, home ranges overlap. The densities of tortoise populations range from 20 to 150 individuals per square mile (Averill-Murray et al. 2002 as cited in Beier et al. 2008). Tortoise dispersal across valleys between desert mountains is estimated to occur approximately once per generation (Edwards 2003), but seems to be very important for the long-term maintenance of populations (Edwards 2004). Causes of dispersal are not known, but tortoise movement probably provides gene flow between populations, may augment declining populations, and allows recolonization of extirpated populations (Howland and Rorabaugh 2002). Due to the observed Maricopa Mountain population decline in the 1990s and resultant low population densities of the tortoise near the Project Area, dispersal rates are expected to be unusually low. For the linkage model, land cover was weighted as the most important factor influencing dispersal patterns (50%), with topography weighted at 35% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" habitat for desert tortoises.

3.19.6.3.2 Less Mobile Species

Badger and Kit Fox

Both the badger and kit fox were chosen as focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. These species are known to occur in the Project Area and analysis area. The badger is a burrowing animal that is capable of excavating burrows even in very rocky terrain. Kit foxes require more brittle soils for burrow construction, but not so loose that they will not support burrows. Kit fox populations are managed for hunting by the AZGFD as a predator (AZGFD 2009a), and their populations are considered secure. Burrows attributed to both species were observed during site reconnaissance surveys, but not in very high densities.

Javelina

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. It is found in dense vegetation, and prefers habitats such as desertscrub and thickets along creeks and washes. It is often found in habitats containing prickly pear cactus, palo verde, jojoba (*Simmondsia chinensis*), and ocotillo (Ticer et al. 2001 and Hoffmeister 1986 as cited in Beier et al 2008a). This species travels in herds, with home range estimates of between 1.9 km^2 and 5.5 km^2. Dispersal distances have not been adequately studied, but they are capable of movements of up to several kilometers (Beier et al. 2008). Land cover was weighted as the most important factor influencing dispersal patterns (50%), with elevation second at 30% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "optimal" habitat for javelina. This species has such broad habitat requirements that most of the area analyzed by Beier et al (2008a) was found to be "optimal" core habitat.

Gila Monster

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Although the banded Gila monster (*H. s. cinctum*) is a BLM sensitive species, the subspecies whose range includes the analysis area is the reticulated Gila monster (*H. s. suspectum*), which may not be collected but is not otherwise considered sensitive by the AZGFD (AZGFD 2009a, Beck 2005). Gila monsters are most often associated with rocky, brushy ravines and low foothills of desert mountains. Areas of high cover, preferably rocks, are important (Beck 2005). They occur on valley floors, often using drainages as avenues of travel, but require animal burrows as shelter in the absence of rocks. The Sonoran Creosotebush-Bursage Scrub vegetation community dominating the Project Area is not preferred Gila monster habitat, due in part to the low food resources available. Home ranges of Gila monsters vary from 32 to 173 acres and up to 2.5 miles in length (Beck 2005). They are assumed to be capable of dispersing up to 8 km or more (Beier et al. 2008). The linkage may be important for long-term viability of the regional metapopulation of the Gila monster. To date, no Gila monsters have been observed in the Project Area. For the linkage model, topography was weighted as the most important factor influencing dispersal patterns (45%), with elevation second at 35% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" habitat for Gila monsters.

Sonoran Desert Toad

This species was chosen as a focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. The Sonoran Desert toad (*Ollotis* [*Bufo*] *alvarius*) may be present in the analysis area, but is not likely to occur in large numbers. Because of their large size this species requires a longer development time to reach adulthood after metamorphosis, and unlike most desert toads, this species will emerge prior to the onset of the

monsoon and use semipermanent water sources for breeding (Fouquette et al. 2005). In the analysis area, they would likely occur in human-made water developments such as agricultural irrigation ditches and earthen livestock ponds.

Regional populations of this species are considered secure. The Sonoran Desert toad normally breeds in valley interiors in temporary catchments in response to significant rainfall events, but will breed in rocky canyons with significant tinajas (semipermanent pools), which may occur in the Buckeye Hills and North Maricopa Mountains in the analysis area. Although dispersal capabilities and patterns of Sonoran Desert toads are not fully known, dispersal distances greater than 2.6 km have not been documented in Nearctic bufonid populations (Bradford et al. 2003; Sinsch 1992). They have not been observed in the Project Area, although surveys designed to observe this species have not been conducted. The CCC stock pond located in the Project Area is within the Buckeye Hills-Sonoran Desert National Monument linkage, and is the most likely place in the Project Area for Sonoran Desert toad breeding and movement to take place.

Tucson Shovelnose Snake

This species was chosen as a focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. In 2010, listing the Tucson shovelnose snake as threatened or endangered under the ESA was found to be warranted, but precluded by higher priority actions (75 *Federal Register* 16,050). It is currently listed as a candidate species. A field review was conducted in September of 2009 that revealed a lack of suitable habitat in the Project Area for the Tucson shovelnose snake (Pape 2009). Project Area soils are dense and are not brittle or sandy enough to be suitable for shovelnose snakes. Further, soils suitable for the Tucson shovelnose snake would not occur in either the Buckeye Hills or the North Maricopa Mountains.

CHAPTER 4.
ENVIRONMENTAL CONSEQUENCES

4 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter presents the anticipated environmental consequences of the development actions proposed under each of the alternatives described in Chapter 2. The four alternatives, one sub-alternative, and two options addressed below are analyzed.

The **No Action alternative** forms the baseline against which the potential impacts of the Proposed Action and the other action alternatives are compared. Thus, it includes current actions and activities in the Project Area. Under the No Action alternative, the SSEP would not be developed, and existing land uses (i.e., livestock grazing, dispersed recreation, mining, and utilities) in the Project Area would continue.

The **Proposed Action** would consist of two independent, concentrated solar-powered electricity-generating facilities with nominal net electrical outputs of 125 MW and 250 MW. The Proposed Action would use a wet-cooling tower for power plant cooling.

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be operated using a dry-cooling technology rather than the wet-cooling technology considered under the Proposed Action.

Sub-alternative A1 was developed in response to agency and public comments on the draft EIS as an alternative to Alternative A for reducing water consumption. Sub-alternative Al would use PV technology instead of solar thermal technology to reduce water use, as well as decrease the project footprint and avoid other sensitive resources raised by the public and agency cooperators. This sub-alternative was originally eliminated from further analysis in the draft EIS due to technological and economic infeasibility. However, advancements in technology and changing market conditions have allowed a reconsideration of PV technology in the final EIS.

Alternative B was developed to respond to issues identified during agency and public scoping, including impacts to wildlife linkages and travel corridors, impacts to residential areas, impacts to xeroriparian vegetation and washes, impacts to water use, and the overall level of surface disturbance resulting from the SSEP. Under Alternative B, the SSEP would consist of two independent, concentrated solar-powered electricity-generating facilities, each with nominal net electrical outputs of 125 MW (for a total of 250 MW), rather than 375 MW considered under the Proposed Action. This alternative would also use a wet-cooling tower for power plant cooling. The reduction of generating capacity would allow a reduced project footprint.

A **Brine Concentrator Option** was developed to further respond to concerns regarding consumptive water use by the SSEP. This optional component could be added to either of the alternatives utilizing a wet-cooling system (i.e., the Proposed Action or Alternative B). A brine concentrator would reduce the volume of wastewater exiting the facility, reduce evaporation pond sizes, and reduce plant water consumption about 7%.

A **Gen-tie Line Option** was developed as an alternate gen-tie line alignment, which could be applied to any of the action alternatives. The Gen-tie Line Option is a different means of routing produced electricity from the SSEP solar field to the Jojoba Switchyard. This option would address alternate methods and locations for crossing existing high-voltage transmission lines located west of the Project Area, as well as an alternate route through existing designated utility corridors that may be subject to future development.

For the analysis, BLM staff used existing data, appropriate scientific methodologies, and professional judgment. The analysis takes into account the applicant-committed measures described in Table 2.2, the applicable RMP stipulations and BMPs in Table 2.1, and the LORSs as described under each resource heading in Chapter 3. This analysis was done using the best-available information, including (but is not limited to) landscape-level data such as Gap Analysis Program (GAP) level vegetation data, Soil Survey Geographic Database soils data, and state agency information on wildlife habitat boundaries. Impacts from actions to be carried out under more than one alternative are discussed under the first applicable alternative. This discussion is then referenced under the other pertinent alternatives.

As discussed in Section 2.5.5.1, it is not possible to predict the conditions and management objectives that would exist at the time of decommissioning. Therefore, for the purposes of this analysis, decommissioning impacts are generally assumed to be the same as those for construction. The consideration of decommissioning impacts at a greater level of detail would be speculative; therefore, they are not considered in the EIS beyond this assumption regarding their similarity to construction impacts.

4.1.1 Types of Impacts to be Addressed

Only those resources and resource uses that would potentially be impacted by any of the alternatives are brought forward for detailed analysis and discussed in Chapter 4. Impacts are defined as modifications to the existing environment brought about by implementing an alternative. Impacts can be beneficial or adverse, result from the action directly or indirectly, and can be long term, short term, temporary, or cumulative in nature.

Direct impacts are attributable to implementation of an alternative that affects a specific resource, and generally occur at the same time and place. Indirect impacts can result from one resource affecting another (e.g., soil erosion and sedimentation affecting water quality) or can occur later in time or removed in location, but can be reasonably expected to occur. Long-term impacts are those that would substantially remain for many years or for the life of the project. Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly and without long-term effects.

The analysis in this chapter provides a quantitative or qualitative comparison (dependant on available data and nature of the impact) between alternative impacts and establishes the severity of those impacts in the context of the existing environment. The discussion of each resource includes sections for specifically required disclosures under NEPA, including the disclosure of residual impacts, irreversible and irretrievable commitment of resources, and the impact of the project's short-term resource use on the long-term productivity of the Project Area. These required disclosures are explained in the sections below.

4.1.1.1 MITIGATION AND RESIDUAL IMPACTS

The mitigation measures identified in Chapter 4 consist of potential additional mitigation not included as applicant-committed measures under any of the alternatives (including measures outside the jurisdiction of the lead or cooperating agency) that could be implemented to address impacts that would result from

the project's implementation. The residual impacts section addresses impacts that cannot be avoided by the application of mitigation measures. This section therefore discloses the effectiveness of proposed mitigation measures for each resource, and helps the decision maker identify those mitigation measures to be included in the record of decision.

4.1.1.2 IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF RESOURCES

Irreversible and irretrievable commitments of resources (in other words, irreversible and irretrievable impacts) are disclosed in this chapter for each resource. Irreversible impacts are those impacts that would result in changes to the environment that cannot be reversed, reclaimed, or repaired. An example of an irreversible impact would be the removal of groundwater from a poorly recharged aquifer. Once groundwater reserves are removed, they cannot be replaced or reclaimed. Irretrievable impacts are those impacts that result in the temporary loss or degradation of the resource value until reclamation is successfully completed.

4.1.1.3 RELATIONSHIP OF SHORT-TERM USES TO LONG-TERM PRODUCTIVITY

This section describes how the short-term project use would affect the long-term productivity of a given resource.

4.1.2 Regulatory Requirements, Mitigation and Monitoring Measures

All SSEP operations would comply with pertinent state, federal, and local LORS. Because LORS are generally specific to a resource, they are presented in Chapter 3 (Affected Environment) of this EIS, which describes the current environment and its management. In addition, Section 1.6 (Relationship to Policies, Plans, and Programs) summarizes existing state, federal, and local requirements that would be required under any of the alternatives. Regulatory requirements, mitigation and monitoring measures, and applicant-committed environmental protection measures particular to each resource are also identified in specific resource sections.

4.1.3 General Analytical Assumptions, Guidelines, and Notes

The following are the general assumptions used for assessment under all alternatives. Assumptions associated with a given resource (e.g., wildlife habitat) are included within the impacts analysis for that resource.

- Short-term impacts are those that would last fewer than five years.
- Long-term impacts are those that would last five years or more.
- Acreages were calculated using GIS technology; there may be slight variations in total acres between resources. These variations are negligible and will not affect analysis.
- All acreages and percentages presented in this chapter pertain to all lands in the Project Area (rather than only BLM lands), unless otherwise specified.
- All alternatives incorporate applicable BMP and management stipulations from the *Lower Gila South Resource Management Plan* (BLM 1985), as amended (BLM 2005a; 2009a), by reference.

<u>As discussed in Section 2.5.2.5.3, minor changes have been made to the design and alignment of the proposed gen-tie line since the publication of the draft EIS. These changes affect all action alternatives equally and would result in impacts of the same nature and general magnitude as discussed in the draft EIS.</u>

Under the revised gen-tie alignment, 33.52 acres of surface disturbance would be required west of the solar field for roads and other gen-tie construction. This compares to a total of 33.25 acres under the original alignment discussed in the draft EIS, which is a difference of 0.27 acre or less than a 1% increase in surface disturbance. With a total surface disturbance of approximately 3,620 acres for the Proposed Action, this amounts to an overall increase in surface disturbance of approximately 0.01%. Surface disturbance acreages and resource impacts analyses for the alternatives have therefore not been updated in the final EIS.

All acres are approximate. Some acreage estimates refer to stand-alone components of the project (e.g., the solar field). Please see Chapter 2, Section 2.5.1.1, and Chapter 3, Section 3.1.1, for more information.

4.2 Air Quality

This section describes the impacts to air quality associated with the construction and operation of the SSEP. Impacts to air quality are discussed in terms of project emissions of criteria air pollutants, visibility of plumes, and compliance with air quality regulations and standards. The impacts described in this section are derived from the modeling and emissions analysis available in the *SSEP Air Quality Technical Report* (Farmer 2010).

Emissions common to all action alternatives would consist of CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, and hazardous air pollutants (HAP). Sources of emissions from the SSEP would include:

- fugitive dust from vehicle travel on unpaved surfaces, especially during construction,
- vehicle exhaust emissions during construction,
- windblown dust from disturbed areas, and
- stationary sources during operation consisting of the following:
  - gas-fired supplemental electrical generation components
  - cooling towers
  - emergency diesel generator and fire water pump engines

These impacts are described in terms of 1) total project emissions compared to current emissions for Maricopa County, 2) the probability of causing or contributing to existing exceedances of NAAQS, and 3) the likelihood of an emissions plume being visible at recreational sites in the area.

4.2.1 Regulatory Requirements, Mitigation and Monitoring Measures

The SSEP would fall under the air permitting and jurisdiction of the MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal requirements derived from Title 40 of the CFR, and county requirements contained in Regulations II and III of the Maricopa County Air Pollution Control Regulations. The statutory provisions in the CAA and all subsequent amendments are implemented in 40 CFR §§ 50–97. The EPA delegates the authority to administer and enforce many of these regulations to individual states and agencies such as the MCAQD. In such cases, the delegated state agency may write equivalent or more stringent requirements into their own rules, or they can adopt the federal requirements by reference.

Table 4.1 addresses the various federal and county regulatory requirements that would apply to the project. Where appropriate, the rationale that justifies the inapplicability of certain air quality regulatory programs is stated. Because the Project Area is within the incorporated boundaries of the Town of Buckeye, there is one local ordinance pertaining to fugitive dust controls that would also be applicable to the project.

Prior to commencing construction, the SSEP facility would be required to obtain a Title V Air Quality Operating Permit (Title V permit) from the MCAQD (MCAQD 2010b). This permit would incorporate all of the applicable federal rules as specific conditions for compliance. During construction of the SSEP, any dust-generating activities would have to comply with Maricopa County Rule 310, which requires substantive dust mitigation and monitoring. Once the SSEP's natural gas-fired equipment is operational, federal NSPS are among the prominent requirements (also adopted by reference in Maricopa County Air Quality Regulations). Air pollutant emissions would be continuously monitored, in accordance with Federal Acid Rain Program rules.

In accordance with the requirements of the CAA, the MCAQD has prepared a state implementation plan (SIP) to address the specific methods and regulations that would lead to compliance with all NAAQS. In general, the rules contained in the SIP are equivalent to, or less stringent than, rules contained in the current MCAQD Air Pollution Control Regulations. In practice, SSEP operations would comply with applicable rules in MCAQD Regulations I, II, and III, and would comply with the SIP. The compliance status and methods to maintain compliance with these requirements are described in the following sections. All applicable SIP rules would be cited in the SSEP's requested Title V permit.

Another set of criteria that pertains to air quality significance is the Maricopa County thresholds for applicability of BACT. Several of these thresholds could be exceeded by the SSEP stationary sources on a maximum daily emission rate basis (Farmer 2010). Therefore, the SSEP would be required to apply suitable BACT measures, and would accept in its permit emission limitations that are consistent with a top-down BACT determination. Although the Title V permit has not been finalized, the following BACT limits are proposed in the permit application:

- 0.0120 pound NO_x/MMBtu for the natural gas co-fired units
- 0.0500 pound CO/MMBtu on a 3-hour average basis for the steam boiler and process heaters
- 0.0160 pound VOC/MMBtu for both steam boilers and process heaters on not less than a 3-hour basis
- 0.0100 pound PM_{10}/MMBtu, 0.0100 pound $PM_{2.5}$/MMBtu, and 0.0110 pound NO_x/MMBtu for small boilers
- 0.1000 pound NO_x/MMBtu for the HTF freeze-protection heaters
- 0.0190 pound CO/MMBtu for auxiliary boilers
- 0.0029 pound VOC/MMBtu for auxiliary boilers
- 0.1200 pound CO/MMBtu for HTF freeze-protection heaters
- 0.0029 pound VOC/MMBtu for HTF freeze-protection heaters
- 0.0050 pound PM_{10}/MMBtu for both the HTF freeze-protection heaters and the auxiliary boilers
- 0.0050 pound $PM_{2.5}$/MMBtu for both the HTF freeze-protection heaters and the auxiliary boilers

A complete analysis of the BACT measures that may apply to the gas-fired generation HTF process heaters, auxiliary boilers, and other fuel-fired sources is provided in the MCAQD Title V permit for the SSEP. The BACT measures that were identified in the permitting analysis are applied to the emission inventory for the SSEP, and reflect the mitigation measures described in this impacts analysis.

An SIP conformity analysis is another applicable process that would be prepared in accordance with the general conformity rule promulgated by the EPA on November 30, 1993 (58 *Federal Register* 63214). The purpose of the rule is to ensure that federal actions conform to the SIP applicable to the Project Area. The applicable regulations are provided in 40 CFR § 51 Subpart W, and Part 93. A *federal action* is defined as any activity engaged in by a federal agency, department, or other entity, or any activity licensed, permitted, funded, or otherwise supported by a federal entity. Because the SSEP would be developed on federal BLM land, which may also involve federal financial assistance, the construction and operation of the SSEP would be a federal action. In such cases, *Conformity to a SIP* is defined as adherence to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

As a result of the general conformity rule, federal actions must be evaluated for conformity to the local SIP if the project 1) is located within an EPA-designated nonattainment or maintenance area; 2) would result in emissions above major source threshold quantities of a criteria pollutants; 3) is not a listed exempt action; and 4) has not been accounted for in an EPA-approved SIP.

In serious nonattainment areas, such as Maricopa County, the de minimis level for PM_{10} is 70 tpy. The de minimis level for ozone precursors (100 tpy of NOx and VOCs) also apply due to the location of the project in an 8-hour ozone nonattainment area. As shown in Table 4.5, the SSEP facility would not exceed any de minimis level during the operational phase. At the time of this writing, construction emissions have not been calculated on an annual basis for comparison with the de minimus level; however, as part of the Proposed Action (see Table 2.2), the proponent has committed to meeting de minimus levels of construction emissions. This would be a necessary step for the conformity analysis. Therefore, the SSEP would be a minor source of air emissions during both the construction and operational phases, and further analysis under the general conformity rule is not necessary.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
Federal		
Federal New Source Review (NSR)/Prevention of Significant Deterioration (PSD) 40 CFR § 51, Subpart I and 40 CFR § 52.2(1), and for new major sources comparable requirements are incorporated in Regulation. II Rules 210 and 240	In general, the NSR/PSD rules define a "major source" as any source with the potential to emit 250 tpy or more of a criteria pollutant. A more stringent threshold is defined for a limited number of *categorical sources*, source categories for which the PSD applicability threshold is 100 tpy of any criteria pollutant. Neither of these thresholds would be exceeded by the project during full operation.	Based on the estimated, maximum potential emissions for the proposed gas-fired generating options, considering the operational constraints on gas-fired generation, the project would not be a *major source*, and therefore the NSR/PSD programs do not apply to this project.
NSPS, 40 CFR § 60	The proposed facility and emissions units would be subject to several subparts of the federal NSPS, which are located in 40 CFR § 60: • Subpart A – General Provisions • Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units. The regulatory requirements in this subpart for units fired solely on natural gas are relatively minimal, compared to solid-fuel or oil-fired units. Primarily, the SSEP facility would have to document the boiler information, and certify that pipeline quality natural gas is the only fuel used. • Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Even though these units would see only occasional routine operation for readiness testing and maintenance, there are applicable requirements under NSPS Subpart IIII. The requirements include emissions standards for NO_X, CO, and hydrocarbons (depending on engine rating and model year); documentation of compliance with the emission standards through manufacturer data; and record keeping of engine maintenance activities and operating time.	The affected sources at the SSEP facility would be the separate gas-fired auxiliary boilers for the 125-MW and 250-MW plants, which have the preliminary design heat input rating of 30 million MMBtu per hour. The 125-MW and 250-MW plants would each have a diesel-engine driven emergency generator and an emergency fire-water pump.
40 CFR §§ 72 and 75, Acid Rain Program Emission Monitoring	Because the SSEP would be a new facility with a capacity greater than 25 MW, it would be subject to the federal Acid Rain Program that is administered by the EPA Clean Air Markets office, in cooperation with MCAQD. The co-fired boilers or HTF process heaters would be subject to a range of monitoring, quality assurance, record keeping, and reporting requirements under 40 CFR § 72, § 75, and attached appendices. These requirements are generally incorporated in MCAQD Air Pollution Control Regulations by reference (MCAQD Rule 371). Alternative monitoring options that may be available include fuel flow monitoring to provide SO_2 and CO_2 emissions estimates (40 CFR § 75, Appendices D and F). Further, the SSEP facility may exercise an option in 40 CFR § 75 Appendix E for estimation of NO_X emissions using a testing-based correlation. Additional details regarding the procedures for monitoring compliance are discussed in the Title V air permit application supplied to MCAQD.	The gas-fired generating operations of the SSEP facility would be required to obtain an Acid Rain Permit. In addition, the co-fired boilers or HTF process heaters would be subject to a range of monitoring, quality assurance, record keeping, and reporting requirements.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
The National Emission Standards for Hazardous Air Pollutants (NESHAP) rules are codified at 40 CFR §§ 61 and 63, and are incorporated in the MCAQD Air Pollution Control Regulations in Rule 370	As part of the NESHAP program, federal maximum achievable control (MACT) standards are enacted to reduce the emissions of federally listed HAP from source categories. In general, the NESHAP regulations apply to affected sources that are located at (or are themselves) major sources of HAP emissions, as defined in 40 CFR § 63.2. That is, any stationary source that emits or has the potential to emit (considering controls in the aggregate) 10 tpy or more of any single HAP or 25 tpy or more of any combination of HAP.	Consideration of NESHAP Subparts in 40 CFR § 61 and 63 indicate that none of these regulations apply to the SSEP, primarily because the annual emissions of HAPs would be well below the applicability threshold for major sources.
40 CFR § 64 – Compliance Assurance Monitoring Program	The federal regulations implementing compliance-assurance monitoring (CAM) apply to major sources that must obtain a Title V operating permit pursuant to 40 CFR § 70. The CAM rules are primarily aimed at emission units that are individually above major source thresholds and that utilize control devices in order to comply with an emission limitation (40 CFR § 64.2). The emission units for the SSEP facility consisting primarily of gas-fired equipment would be subject to operational limitations under the requested permit that would avoid emissions above the major source thresholds.	The SSEP facility is not a major source of criteria pollutants; consequently, the facility would not be subject to CAM requirements.
40 CFR § 68 – Accidental Release Prevention Program/Risk Management Plans	The Accidental Release Prevention Program applies to facilities that may store quantities of toxic or flammable chemicals above listed thresholds. The requirements include process hazards analyses, implementation of work practices to prevent releases, and development of site-specific risk management plans.	Based on its process and facility design, the SSEP facility would not store on-site quantities of listed chemicals above the thresholds listed in 40 CFR § 68; therefore, this program would not be applicable to the facility.
40 CFR § 82, Subpart F – Stratospheric Ozone Protection Regulations	Processes at the planned SSEP facility would not involve the use of chlorofluorocarbon (CFC) compounds. Therefore, these operations would not be subject to CFC-related regulations. If facility personnel are to service air conditioning units of sufficient size to be covered under the rule, those personnel would be required to be certified and would have to use certified refrigerant capture equipment. At this time, there is no plan to have in-house servicing of CFC-containing equipment.	Facility operations would not be subject to CFC-related regulations.
40 CFR § 98 – Reporting of Greenhouse Gas Emissions	For the combustion processes at the SSEP facility, this very recent rule requires monitoring, recordkeeping, and reporting of greenhouse gas emissions on an annual basis. In addition to the CO_2 emissions that are tracked under the federal Acid Rain Program (40 CFR § 75), this rule requires calculation of N_2O and CH_4 releases.	The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
40 CFR § 51, Subpart W and 40 CFR § 93 – General Conformity Analysis	Federal actions must be evaluated for conformity to the local SIP if the project 1) is located within an EPA-designated nonattainment or maintenance area; 2) would result in emissions above major source threshold quantities of a criteria pollutants; 3) is not a listed exempt action; and 4) has not been accounted for in an EPA-approved SIP.	The project is located in a nonattainment area for PM_{10} (24-hour and annual) and ozone. The BLM must demonstrate that the SSEP would 1) conform to an enforceable state, tribal or federal implementation plan; 2) not cause or contribute to new violations of an ambient standard; 3) not increase the severity or frequency of existing violations; and 4) not otherwise delay achieving attainment of the NAAQS. Because the SSEP would be a minor source of air emissions during both the construction and operational phases, further analysis under the general conformity rule is not necessary.
State of Arizona		
A.A.C. R18-2-604	Prohibits development of open areas without taking "reasonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of good modern practices, dust suppressants, and the minimization of visible fugitive dust from motor vehicle use on dry open areas.	Applies to permanent clearing of vegetation for the SSEP.
A.A.C. R18-2-605	Prohibits use of roads without taking "reasonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of wetting, dust suppressants, and covering loads.	Applies to all traffic associated with construction and operations of the project.
A.A.C. R18-2-606	Prohibits handling of materials without taking "reasonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of "reasonable precautions" such as wetting and covering loads.	Applies to transport of materials to and from the site.
A.A.C. R18-2-607	Prohibits piles of dust-producing material without taking "reasonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of "reasonable precautions" such as wetting and covering piles.	Applies to piles of soil and other material created during construction of the project.
A.A.C. R18-2-804	Requires that site clearing machinery not exceed an opacity of 40% for more than 10 consecutive seconds or 10 minutes if the equipment is cold. Also prohibits site clearing without taking "reasonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of "reasonable precautions" such as dust suppressants and removal of dust and other materials from paved roads.	Applies to site clearance during construction of the project.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
Maricopa County		
Title V Air Quality Operating Permit from the MCAQD	Prior to commencing construction, the SSEP facility would be required to obtain a Title V Air Quality Operating Permit from the MCAQD. This permit would incorporate all of the applicable federal rules as "Specific Conditions" for compliance.	By rule, because the SSEP generating units would be "Affected Units" subject to the requirements of the Federal Acid Rain Program (Title 4 of the CAA Amendments, the project would be required to obtain a Title V permit.
MCAQD Rule 100 – General Provisions and Definitions	Rule 100 contains general administrative procedures applicable to the SSEP facility as a permit holder under Maricopa County Air Pollution Control Regulations. This rule provides definitions, administrative requirements, as well as general record keeping and reporting requirements.	Among the general provisions are several that define specific compliance actions that would be implemented by the facility: • Retention of records related to air permit compliance for a five-year period after the date of the record (Section 504) • Submittal of an Annual Emissions Inventory to MCAQD in a specified timeframe and format (Section 505)
MCAQD Rule 200 – Permit Requirements	Rule 200 describes the categories of air quality-related permits issued by MCAQD. The designation of the SSEP facility as a Title V source, regardless of potential to emit levels, is contained in Section 302.3: "A Title V permit...shall be required for a person to commence construction of...§ 302.3. Any affected source as defined in Rule 100 – General Provisions and Definitions..."	By submitting an application to MCAQD, the project would be requesting a Title V Air Quality Operating Permit.
MCAQD Rule 210 – Title V Permit Provisions	Rule 210 includes provisions for Title V permit application submittal, review, and permit issuance for facilities in Maricopa County deemed to be "major sources." Requirements for changes allowed without a permit revision and requirements for permit modifications are also covered in Rule 210.	The estimated facility-wide emission levels would qualify the SSEP facility for Synthetic Minor Source status. However, the SSEP facility must be permitted as a Title V facility because of its status as an affected source under the Title IV – Acid Deposition Control in the CAA Amendments of 1990.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 241 – Permits for New Sources and Modifications to Existing Sources	Rule 241 provides control technology requirements for new sources and modifications to existing sources of air pollution requiring permits or permit revisions. This rule is applicable to all new and existing sources other than new major sources and major modifications to major sources. In its permit the SSEP facility would seek the flexibility to operate with gas-fired generation for up to 24 hours during a given day. In addition, up to 25% of the gross generation of the plant (in terms of MWh) would be supplied by gas-fired generation using co-fired boilers or HTF process heaters. Given these operating characteristics, the SSEP facility would have daily and annual emissions above the listed threshold levels (Rule 241, §301) for some criteria pollutants. As described in a subsequent section, the aggregate 24-hour facility-wide emissions of NOx and CO would potentially be above the applicable thresholds for evaluation of BACT (e.g., 150 pounds per day emissions of NOx) under MCAQD Rule 241. Therefore, a "top-down" BACT determination for NOx and CO was performed, and the results are discussed in the MCAQD air permit application. The analysis of BACT control options considered the economic, energy, and environmental factors for technically feasible mitigation measures. Because of the high capital and operating costs for add-on controls on the limited schedule (maximum 25% of the time on an annual basis) for gas-fired operations, the annualized cost for all add-on emission controls (e.g., selective catalytic reduction) proved to be cost prohibitive on a dollars/tons-abated basis. Costs for add-on controls remain fixed despite the fact that they would only be necessary 25% of the year.	
MCAQD Rule 270 – Performance Tests	Rule 270 provides the administrative requirements and performance test criteria for stationary sources. The requested permit includes source emissions units that would be subject to testing requirements. Sufficient demonstration of performance would be required in the air quality permit in the form of periodic performance tests. These tests would be performed periodically by the facility, in conformance with an approved test protocol and in compliance with an approved operating and maintenance plan.	This requirement pertains to the co-fired boiler units, for which performance testing would be required under NSPS Subpart D.
MCAQD Rule 300 – Visible Emissions	Stipulates emission standards for visible emissions from sources for which no source-specific opacity requirements apply. • Section 301 – Limitations Opacity/General. This rule states that no person shall discharge into the ambient air from any single source of emissions any air contaminant, other than uncombined water, "in excess of 20% opacity for a period aggregating more than three minutes in any 60-minute period." • Section 501 – Compliance Determination–Opacity. This rule requires that opacity observations be conducted in accordance with EPA Reference Method 9 as modified by EPA Reference Method 203B. This latter method addresses the appropriate averaging calculations when one or more of the individual readings are above the 20% opacity standard.	Based on the planned gas-fired equipment for the SSEP facility, the auxiliary boilers and the HTF heaters would be subject to this county opacity requirement. For these units, Rule 300 §301 stipulates the applicable opacity limit.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 310 – Fugitive Dust Sources	Establishes standards to limit the emissions of PM into the ambient air from any property, operation, or dust-generating operations that may serve as a fugitive dust source. This rule states that no person shall allow visible emissions that exceed 20% opacity from dust-generating activities (Rule 310, §301). Prior to construction, a dust control plan would be submitted to MCAQD to define how excess opacity emissions would be mitigated, including use of watering trucks, limitations on vehicle speed, and cessation of activity during wind events. Additional requirements pertain to soil stabilization for different types of disturbed areas and roadways (Rule 310, §302). Several field methods are specified in the rule (Section 2.1 in Appendix C to Regulation III), such as verification of surface crust and vegetation, and should be used to verify compliance with the soil surface stabilization requirements.	These standards would apply during the construction phase of the project.
MCAQD Rule 310.01 – Fugitive Dust from Open Areas, Vacant Lots, Unpaved Parking Lots, and Unpaved Roadways	Establishes standards to limit the emission of PM into the ambient air from open areas, vacant lots, unpaved parking lots, and unpaved roadways that are not regulated in Rule 310 and that are not required to have either a permit or a dust control plan. Section 301 requires surface stabilization and work practices to mitigate emissions of PM from certain types of roadway and unpaved surfaces. These measures include application of palliatives, maintenance of surface crust, maintaining adequate vegetation, and other measures. Section 501 requires that surface stabilization observations be conducted in accordance with suitable field methods (Section 2.1 of Appendix C of Regulation III). These include the drop ball test to verify surface crust, measurement of nonerodible elements, and assessment of existing surface vegetative cover.	At the Project Area, there may be sections of plant roadways and parking areas that would not be paved. These areas would be subject to requirements of Rule 310.01.
MCAQD Rule 311 – Particulate Matter from Process Industries	Limits the discharge of PM into the atmosphere from process equipment by establishing emission rates based on process weight rate (defined in Rule 311, Section 206).	The gas-fired equipment emissions units at the SSEP facility, exhausting combustion emissions, are potentially subject to this rule. Should some or all of the gas-fired equipment be deemed subject to Rule 311, the PM limits would be met through the use of pipeline-quality natural gas fuel.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 320 – Odors and Gaseous Air Contaminants	Establishes limits for the emissions of odors and certain other gaseous air contaminants into the atmosphere. The facility would engage in appropriate work practices to comply with each of these requirements: • Section 302 – Material Containment Required. This rule requires that suitable work practices be in place for pollutant-containing materials including, but not limited to, solvents or other volatile compounds, paints, acids, alkalis, pesticides, fertilizer, and manure. These materials shall be stored, processed, used, and transported in such a manner and by such means that they will not unreasonably evaporate, leak, escape, or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. It is expected that such materials would be used at the SSEP facility for maintenance purposes. These provisions also generally apply to the level of control of VOC from the HTF ullage system, which are minimized by the use of carbon canisters to capture vapors. • Section 303 – Reasonable Stack Height Required. This rule states that where a stack, vent, or other outlet is at such a level that air contaminants are discharged to adjoining property, installation of abatement equipment or alteration of the stack may be required to adequately dilute, reduce, or eliminate the discharge to adjoining property. This general requirement is applicable to process vents and gas-fired equipment. The configurations of the planned stacks and vents would be designed to meet the Rule 320 requirements, and the position and arrangement of the stacks would be adequate to disperse the exhausted emissions.	Only the most generalized emission and work practice standards in this rule would be applicable to the SSEP facility, because other source specific standards are applied from other MCAQD rules.
MCAQD Rule 322 – Power Plant Operations	This rule was most recently revised in October 2007 and regulates the discharge of combustion-related pollutants from stationary fossil-fuel-fired equipment at existing power plants. Specifically, the rule is applicable to electric utility steam generating units with heat input capacity equal to or greater than 100 MMBtu/hour, and for which construction commenced prior to May 10, 1996.	By virtue of the commencement date, the SSEP facility would not be subject to this county rule.
MCAQD Rule 323 – Fuel Burning Equipment at Industrial, Commercial, and Institutional Sources	This rule, most recently revised in October 2007, addresses emission control standards and associated requirements for fuel burning equipment at industrial, commercial, and institutional facilities. This rule is potentially applicable to the gas-fired equipment that is not related to power generation. However, the exemptions in Section 103 apply directly to each category of SSEP facility equipment. These exemptions identify "combustion equipment used in power plant operations for the purpose of supplying greater than one-third of the electricity to any utility power distribution system ..." (Section 103.6). Further, an exemption for "direct-fired process heaters" applies to the HTF heater units used for natural-gas–fired generation (Section 103.3).	Based on the current design, there would be no equipment at the SSEP facility that would be subject to this rule.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 330 – Volatile Organic Compounds	Rule 330, Section 301 establishes limits for the emissions of VOCs into the atmosphere that may result from the use of "organic solvents" or processes that emit VOCs. The SSEP's HTF system and storage tanks would be considered processes with the potential to emit VOC. The HTF compounds would be considered, as Group II, noncomplying solvents. A key design feature of the ullage/flash system is that the reservoir of HTF would be continuously blanketed with nitrogen to avoid contamination and oxidization of the organic constituents. From Section 302 of Rule 330, a maximum emission limitation of 40 pounds (18 kg) per day is imposed on "any machine, equipment, device or other article for employing...any such noncomplying solvent, unless the entire amount of such discharge has been reduced in accordance with Section 304 of this rule." This limitation would apply to the remainder of the HTF storage and handling system. Based on engineering simulation calculations for the SSEP'S HTF storage tanks, and including the benefit of activated carbon canister controls on tank vents, the HTF would not be evaporated in an amount that could exceed 40 pounds per day.	The design of the HTF system makes Section 301 not applicable to the HTF ullage/flash process.
MCAQD Rule 372 – Hazardous Air Pollutants Program	This regulation applies to sources of HAP, with individual HAP emissions above 10 tpy, and combined HAP emissions of 25 tpy or more. The rule is applicable to facilities with specific Standard Industrial Classification (SIC) codes, and an electric generating facility (SIC 4911) is not one of the regulated SIC code categories identified in Rule 372, Section102.1.a.	The future status of the county program is uncertain, because the Arizona state program, after which the MCAQD program is patterned, has been subject to legal challenges.
Local – Town of Buckeye		
Ordinance No. 14-08 Dust Control	Because the SSEP site would be within the boundary of the Town of Buckeye, this town ordinance is also applicable to the project. This ordinance either matches or extends the MCAQD requirements for dust control measures. Included are measures for stabilization of unpaved areas, restrictions on leaf blowers, and speed limits for high traffic dirt roads.	MCAQD is primarily responsible for administration and enforcement of air quality controls. The planned measures for use of gravel and soil binder applications satisfy the applicable sections of this town ordinance for unpaved area stabilization.

4.2.2 Analysis Area and Analysis Assumptions

4.2.2.1 PROJECT EMISSIONS CALCULATIONS

As described in Chapter 3, the analysis area for air quality is the Maricopa County serious nonattainment area for PM_{10}, which is the regulatory boundary used for air quality assessment in which the SSEP would reside. The area of analysis and the Project Area are shown in Map 8. Estimated emissions under each action alternative are provided in Sections 4.2.4.1, 4.2.5.1, 4.2.6.1, and 4.2.7.1.

4.2.2.1.1 Windblown and Fugitive Dust Emissions

The following assumptions were used in the calculation of dust emissions during construction of the SSEP project. The overall construction duration for the Proposed Action and Alternative A would be 39 months for the 125-MW and 250-MW generation plant sections (37 months for Alternative B and 25 months for Sub-alternative A1). For the Proposed Action, construction of the two plant sections may overlap in time, but the months of peak activity for both sections of the SSEP would not occur at the same time. Construction phase air emissions for the SSEP would vary on a monthly, and even a daily basis. The specific location and intensity of construction activities would evolve during construction, as earthmoving and construction activities move across the SSEP site. The construction phase emission inventory is based on the projected highest-activity months during the construction schedule. Peak construction activity for the 250-MW block (assumed for the Proposed Action and Alternative A) is slightly less than the peak construction activity for the 125-MW block (assumed for Alternative B); however, peak construction activity is least for Sub-alternative A1.

To quantify dust emissions from industrial and commercial facility construction, an emission factor of 0.19 ton PM_{10}/acre-month was multiplied by the total acres of land under active construction at a given time. This emission factor is based on recent recommendations for construction in western states (WRAP 2006) and does not assume a particular set of mitigation measures, other than the typical range of soil moisture and silt content in western soils. Over the course of construction, a large number of truck deliveries of roadway materials would be delivered to the site. Therefore the project includes the development of a network of improved-surface plant roads within the extensive parabolic trough solar field. This activity is within the type of operations considered in the development of the general construction PM_{10} emission factor that is representative of earthmoving projects in western states (WRAP 2006).

In Maricopa County, the status of the area as a serious nonattainment area for PM_{10} has prompted the MCAQD to adopt some of the most stringent dust control regulations in the nation (see Table 4.1). The construction and operational phases of the project would be subject to these requirements. MCAQD regulations related to fugitive dust sources are aimed at substantially reducing the mass emissions of particulates and the release of visible emissions. Emissions of particulate species due to earthmoving equipment would be limited by the stringent mitigation measures that are imposed by Maricopa County Rule 310 and A.A.C. R18-2. This rule requires that visible emissions associated with fugitive dust be limited to 20% opacity. The rule requires a dust control plan prior to construction that details mitigation measures that would be employed to ensure compliance with this standard. A copy of this plan would be maintained at the site and available for public or county inspector review. Subsequently, the construction contractors and project representatives would be required to monitor the adequacy of the dust mitigation measures by making opacity emission observations not less than daily. Records of these opacity observations must be maintained at the

construction site. The impacts analysis assumes that all of these regulations would be fully attained by the SSEP. Dust control measures prescribed by MCAQD Rule 310 include:

- Frequent application of water to active earthmoving areas
- Restriction in construction vehicle speeds on unpaved roadways (e.g., less than 15 miles per hour [mph])
- Application of gravel or other surface palliatives to unpaved areas and roadways
- Restriction or cessation of construction activities during "high-wind" events
- Covering or otherwise shielding stock piles of soil or similar construction materials
- Installation of vehicle "track-out" areas or wash-down areas to prevent fine dust from being tracked onto adjacent paved roads

Construction activities would also generate emissions of $PM_{2.5}$, which has more recently become regulated as a criteria air pollutant. Guidance from the EPA indicates that emissions of $PM_{2.5}$ are to be quantified as a fraction of the total PM_{10} emissions. The ratio of $PM_{2.5}$ to PM_{10} emissions for SSEP construction dust emissions was assumed to be 0.208, based on documentation in EPA Document AP-42 and in other publications (EPA 1995, SCAQMD 2006).

During operation of the SSEP, MCAQD Rule 310.01 requires that dust suppression measures be applied to all disturbed surface soils to reduce the likelihood of windblown dust. Measures such as watering/crusting, application of palliatives, or installation of a layer of gravel are required, as necessary, and the permanence and efficacy of the stabilization must be periodically evaluated by field measurements of soil surface condition (MCAQD Rule 310.01). Under Rule 310.01, open areas and vacant lots (Section 302.4) would not result in visible emissions of PM beyond the property line. Fugitive dust emissions associated with unpaved parking lots would not exceed 20% opacity (Section 302.5). The measure requires that control measures be implemented within 60 days. Control measures include establishment of vegetative ground cover, application of a dust suppressant or surface gravel, and/or restoration of disturbed surface areas to conditions similar to undisturbed native conditions (Section 302.1). Control measures are considered to be effectively implemented when the open area meets one of the following criteria (Section 302.2): a visible crust demonstrates soil stability, a friction velocity threshold is met, vegetative cover thresholds are attained, or an alternative method is approved by EPA.

Dust suppression measures are necessary for the operation of the solar collection array. Dust accumulation on the mirror surfaces reduces solar collection efficiency and must be washed off periodically. This has become an accepted practice for large solar-generation facilities, and the SSEP facility would maintain substantive dust abatement measures throughout the operational period of the project. Therefore, in addition to the measures required by MCAQD during construction, the proponent has committed to specific dust suppression measures. The main access road, selected areas around the gates, and parking lots would be paved. Other areas around the power block would be graveled. In addition, the maintenance roads between the collector assemblies and other high traffic areas would be treated with a dust palliative as appropriate for the duration of the plant's construction. Exposed vehicle pathways between the collector array rows would be firmly crusted by the penetration and binding action of the palliative solutions. Maintenance roads between the collector assemblies and other high traffic areas would be treated with a dust palliative, as appropriate, for the duration of the plant's operation. In all other disturbed areas, such as beneath the solar collectors, soil would be watered to form a durable surface crust. If dusting conditions at the site create an adverse effect on generation, the proponent would consider treating problem areas with dust palliative, including areas under the collectors that would not be regularly travelled by maintenance vehicles.

The measures required by MCAQD and additional measures committed to by the proponent would reduce overall construction emissions of PM_{10} by over 60% (based on MCAQD control effectiveness estimates) compared to uncontrolled emissions. To allow for a conservative assessment, the actual control effectiveness was assumed to be 50%, compared to uncontrolled levels, and is reflected in the final emissions calculations. The dust suppression measures would also reduce the potential for dust emissions during operations from both vehicle travel and windblown dust. Typical vendor estimates of dust control effectiveness are over 80%, compared to uncontrolled levels on roadways. On areas that are stabilized but not disturbed by vehicles, control effectiveness would be close to 100% after soils have recrusted (Farmer 2010).

4.2.2.1.2 Vehicle Exhaust Emissions of Criteria Pollutants during Construction

Operation during construction of diesel- and gasoline-fueled offroad vehicles and temporary stationary equipment generates emissions of gaseous pollutants including NO_X, CO, and VOC. To conservatively estimate the potential emissions of gaseous pollutants, these emissions factors were applied to the highest estimated number of vehicles and equipment expected to be present during the maximum activity month during construction (month 6 for both 125-MW and 250-MW sections). The estimates presented here assume that all equipment in each category would operate full time during the hours estimated for the most active month.

Emission factors associated with the average fleet make-up of construction equipment in 2010 were obtained from the *South Coast Air Quality Management District (SCAQMD) Emissions Handbook* (SCAQMD 1993, 2008) and were used to assemble the inventory of emission rates for equipment exhausts. For the current equipment, the SCAQMD factors are based on at least Tier II engine performance, and use of ultra-low sulfur diesel fuels that are now mandatory in California, Arizona, and elsewhere. The gaseous pollutant emission factors used in the emission inventory are based on this level of performance (SCAQMD, 1993, 2008). The SCAQMD factors are expressed in units of pounds of pollutant emissions per hour, at a given horsepower range, for different categories of equipment. The roster of planned construction equipment during the maximum activity month, and the associated SCAQMD emissions factors for on-site construction activities are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

4.2.2.1.3 Emissions of Criteria Pollutants from Stationary Sources during Operations

The generation of electrical power using parabolic trough solar thermal technology does not result in criteria pollutant emissions. During the operational phase, SSEP emissions would be generated predominantly by combustion sources associated with either the co-firing boilers or the HTF heaters and would be emitted from several stationary, point-source stacks. As part of the project application for an air quality permit, an evaluation of BACT was conducted for NO_X, CO, and particulate emissions. The project design incorporates the proposed emission controls identified as BACT, and operation of these controls would be enforceable requirements in the Project Air Quality Operating Permit, issued by MCAQD.

Operational phase emission rates were evaluated on maximum hourly and total annual bases (Farmer 2010). For purposes of characterizing maximum hourly emissions, the SSEP facility equipment was assumed to be operating at maximum rated capacity. These hourly rates are used for the dispersion modeling analysis (SCREEN3) of operational phase impacts, and for the assessment of visible plumes.

Under Alternative A, the allowable gas-fired generation would be reduced by 9% from the Proposed Action, which was assumed to correspond to a 9% reduction in all emission associated with gas-fired generation. Under Alternative A, there were also no assumed emissions from cooling towers because they would not be employed under this alternative. Under Alternative B, emissions estimates assume two 125-MW HTF process heaters and two 1,000-kW generators. It was also assumed that plant vehicle travel on paved and unpaved roads would be reduced by 33% under Alternative B. All other components of the SSEP were assumed to be the same for Alternative B, compared to the Proposed Action. There are no operational emissions from point sources under Sub-alternative A1 because gas-fired generation, freeze protection heaters, and cooling towers would not be required under this alternative.

Gas-fired Supplemental Electrical Generation

The 125-MW and 250-MW generating plants would use natural gas-fueled equipment to improve operating flexibility and maximize output of the plant during periods of low solar thermal input. However, the electricity generation supplied by gas-firing would be limited to 25% of total facility output on an annual basis. Three components make up the gas-fueled generation of electricity:

1. **Gas Co-fired Electrical Generating Units:** Co-fired HTF process heaters would modulate and supplement steam production in response to load demand during each operating day. Heat input would be provided via a combustion system designed to reduce emissions of NOx and other pollutants. The system includes low-NOx burners (LNB) and advanced controls to promote complete and efficient combustion at all loads. One possible option for each solar-generating plant at the SSEP is the use of natural gas-fueled, co-fired steam generating boilers, sized to provide full plant nominal output capacity at night or during other times of low incoming solar radiation. The heat duty requirements and emission characteristics for each of the generation plants are comparable to the HTF process heater design. Emission controls would be included in the design (i.e., LNB with induced flue gas recirculation technology) to achieve specified NO_X emission levels at all loads.

2. **Auxiliary Boilers:** For each of the two generating plants, a 30-MMBtu/hour-rated auxiliary boiler would provide steam for the steam turbine gland seal steam system, deaerator start-up sparging steam, steam jet air ejector, and other minor steam consumers while the steam turbine generators are offline and during start-up.

3. **Heat Transfer Fluid Freeze-protection Heaters:** A 30-MMBtu/hour gas-fired, direct contact HTF heater in each generating plant block would be used as needed to keep the HTF at or above 100°F whenever the facility is offline. This would include periods of shutdown for routine events such as periodic maintenance primarily in the winter months. The HTF heater is similar to the auxiliary boiler except that it uses the organic HTF oil instead of water in the tube bundles. The gas-fired process heaters would be equipped with low-NOx burner technology and flue gas recirculation as pollution control measures. In addition, the annual operating schedule, or total heat input, would be limited by the facility's air quality permit to prevent gas-fired generation from exceeding 25% of the facility's annual production.

Annual emissions for the operational phase considers the gas-fired generation HTF process heaters and supporting ancillary equipment according to the maximum, annual schedule shown in Table 4.2. The equipment assumed in the air quality analysis differs slightly from the equipment identified in Chapter 2 of the Proposed Action; however, the capacity of the components and total fuel use assumptions are consistent with assumptions described in Chapter 2. Fuel usage is the most important assumption in calculating expected emissions from the SSEP because emissions are based on the amount of fuel used. Nonetheless, the difference in assumption slightly overestimates emissions associated with the HTF process heaters. Criteria pollutant emission rates for the combustion equipment for the SSEP operational

phase reflect the selections of BACT that would be required for compliance with MCAQD permitting requirements. The emission analysis is based on vendor-specified emission factors in combination with emission factors from EPA Document AP-42 (current sections can be obtained from the EPA TTN Website). More detailed tabulation of emission calculations and a description of the methodology are provided in the *SSEP Air Quality Technical Report* (Farmer 2010). The gas-fired supplemental generation would not be used in the SSEP under Sub-alternative A1.

Table 4.2 Operating Parameters for the 125-MW and 250-MW Gas-fired Supplemental Systems

Unit	Output Capacity (MMBtu/hour)	Annual Hours of Operation at 100% Load	Annual Thermal Energy Produced (MMBtu/year)[1]	Annual Thermal Input (MMBtu/year)[2]
125-MW Plant				
HTF process heater[3]	1,300	689	895,700	1,120,000
Auxiliary boiler[4]	30	1,000	30,000	37,500
HTF freeze-protection heater[4]	30	2,500	75,000	93,750
250-MW Plant				
HTF process heater	2,550	693	1,767,000	2,210,000
Auxiliary boiler[4]	30	1,000	30,000	37,500
HTF freeze-protection heater[4]	30	2,500	75,000	93,750

[1] Annual thermal energy produced is the output capacity for the equipment multiplied by the annual hours of operation.

[2] Annual natural gas thermal input is based on the assumption that the boilers/heaters have an 80% thermal efficiency.

[3] Annual operating hours for the HTF process heaters are the equivalent hours of full-load (375 MW) operation that equate to annual gas-fired generation output (equal to 25% of the total maximum capacity of the plant). Actual operating hours per year would be higher, with a substantial portion of the gas-fired generation at part-load conditions.

.[4] Annual operating hours for the auxiliary boilers and HTF freeze-protection heaters are based on project estimates for maximum design case.

Cooling Tower

The SSEP facility would use wet cooling towers for power plant cooling. Water for cooling tower makeup, process water makeup, and other on-site uses such as mirror washing, would be supplied from on-site groundwater wells. The cooling towers for the 250-MW and 125-MW plants would be emission sources of PM_{10} and $PM_{2.5}$. Aerosol droplets that are released as plume drift from the towers would evaporate in the atmosphere, and the dissolved salts would precipitate to form fine particles. The operational phase inventory includes these cooling tower emissions. The cooling towers would not be used in the SSEP under Alternative A or Sub-alternative A1.

Emergency Diesel Generator and Fire Water Pump Engines

Air pollutant emissions from the emergency diesel generators and fire water pump engines would be subject to emission limits under National Source Performance Standards (NSPS) Subpart IIII. One emergency generator and one fire water pump in each of the 125-MW and 250-MW blocks would be included in the facility design. For these units, the facility would adopt in its permit an operating limitation of no more than 50 hours per year, per engine for routine testing and maintenance of these components. These engines would be compliant with current EPA tier emission performance criteria.

4.2.2.2 CONTRIBUTIONS TO NAAQS

To characterize ambient concentrations due to emissions from SSEP stationary sources (described in the previous section), the EPA SCREEN3 model was used to perform dispersion modeling for criteria pollutants. The SCREEN3 model provides a very conservative analysis to determine whether operational-phase concentration impacts might cause or contribute to exceedances of NAAQS. The screening assessment addresses the large, stationary sources that have the potential for long-term and farther reaching impact.

For the purposes of the SCREEN-3 model, maximum hourly emissions from the following components were assumed: 250-MW process heaters, 125-MW process heaters, and the 1,000-kW generator hourly emissions. Emissions from auxiliary boilers were not included in the screening model because these would only be employed at start up and therefore would not run simultaneously with the other sources included in the model. Emissions from HTF freeze-protection heaters, the 1,500-kW generator, and the fire water pump were not included in the screening model because they would run intermittently and generally not simultaneously with the sources included in the model. The cooling towers were not included in the screening model because they do not have point-source characteristics compatible with the large, hot exhaust stack sources, and thus cannot be treated in the same SCREEN3 model. For this reason, the towers were addressed quantitatively in the plume visibility analysis. The model also does not include intermittent fugitive sources that would result in dust emissions for brief periods, such as operation of maintenance vehicles and windblown dust. Fugitive sources and smaller emission sources that are intermittent and of unpredictable duration were also not included in the screening modeled. Similarly, the air pollutant emissions from operation of in-plant maintenance vehicles are assumed to be small, compared to the modeled generation process sources and they are not included in the analysis. Commuting travel is assumed to result in a very small incremental change compared to existing local traffic, because an estimated 82 workers would be required to operate the facility on a full-time basis. Commuting travel was also not included in the screening-level model. Complete calculations and detailed modeling methodologies are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

The SCREEN3 model assumes that a plume may be emitted in any direction from a single stack that combines similar project source emissions. The model calculates the maximum, 1-hour average, ground-level concentrations at specified distances and elevations from the aggregated SSEP stack. Using accepted scaling values, termed "persistence factors" provided by EPA guidance, the 1-hour SCREEN3 results can be translated to longer averaging times. The model was used to predict ground-level concentrations in all direction, using the "full meteorology" option. This option causes the model to predict concentrations based on an array of more than 50 separate sets of meteorological parameters that reflect a range of poor-dispersion conditions. The SCREEN3 model evaluates ground-level concentrations for each such meteorological condition, and indicates the highest value over a range of distances from the combined project emission sources. A summary of key model inputs for SCREEN3, and the ground-level impacts at the point of maximum concentration for each case, are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

Increases in concentrations associated with project emissions were compared to NAAQS and background monitoring data at the Buckeye monitoring station, which are assumed to be most representative of air quality around the Project Area. Exceedances of the 24-hour and annual PM_{10} NAAQS occur regularly at this station. Although the project is located in an 8-hour ozone nonattainment area, there were no exceedances of the 8-hour ozone NAAQS at the Buckeye monitoring station between 2005 and 2008.

4.2.2.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

The VISCREEN model (EPA 1992; EPA 1988) was used to assess the potential for observers in recreational areas, parks, and wilderness areas located within 50 km of the SSEP to perceive visible plumes from emissions associated with combustion of natural gas (Table 4.3). The impact is modeled as a loss of visual clarity in the direction of the SSEP facility.

Table 4.3 Class II Wilderness Areas and Recreational Areas near the Project Area

Area Name (Managing Agency)	From Project Area to Nearest Boundary	
	Approximate Distance in Kilometers (miles)	Direction
Sonoran Desert National Monument (BLM)	2.2 (1.3)	Southeast to south
Signal Mountain Wilderness (BLM)	34.3 (21.3)	West-southwest to west
Woolsey Peak Wilderness (BLM)	22.7 (14.1)	Southwest to west
North Maricopa Mountains Wilderness (BLM)	4.9 (3.0)	Southeast
South Maricopa Mountains Wilderness (BLM)	28.2 (17.5)	Southeast
Sierra Estrella Wilderness (BLM)	22.5 (13.9)	East
Estrella Mountain Regional Park (Maricopa County)	13.8 (8.6)	Northeast to east-northeast
White Tank Mountain Regional Park (Maricopa County)	43.5 (27.0)	North
Buckeye Hills Regional Park (Maricopa County)	8.9 (5.5)	Northwest

VISCREEN is designed to evaluate, on a relative scale, the ability of an observer to see a visible plume from a range of vantage points due to distant emission sources of PM_{10} and NO_x. The VISCREEN model considers the transport and dispersion of the plume, and also the viewing position of the observer relative to the sun. The analysis accounts for both spatial and temporal factors that affect the visibility of a plume from the SSEP. These factors allow the model to account for occurrences when the wind is blowing in the necessary direction to convey the source plume(s) to a viewer in a given sensitive area while considering intervening topographic features. VISCREEN depicts the plume as having a parabolic shape that broadens uniformly and drifts toward the ground. The VISCREEN representation allows for lateral drift and dispersion of the plume to follow actual winds in the area.

The VISCREEN analysis provides two measures of potential plume visibility, based on contrast with sky and terrain backgrounds. The first is a plume "contrast index," which is the relative difference in light intensity between light scattered through the plume and light scattered from the background. The second index measures plume perceptibility, expressed as the total color contrast (ΔE), because plume perceptibility is a function of both brightness and color. The two indices are related to perception by the human eye. The VISCREEN model output for the SSEP was compared to a perceptibility threshold based on significance criteria that have been developed for federal Class I areas (Federal Land Managers' Air Quality Related Values Work Group [FLAG] 2000). These thresholds are a ΔE value over 2.0 and a contrast of more than 0.05. In general, the assessment procedures outlined in the FLAG guidelines are generally applicable to both Class I and Class II areas (FLAG 2000 and 2008). Note that Class II areas have no visibility protection under federal or state law.

The VISCREEN model is designed to consider the contributions from NO_X and PM_{10} emissions from point-source stacks that have the potential to create visible plumes. For this study, the emission units and pollutants that were used for the visible plume analysis are:

- Electrical generation HTF process heaters (NO_X and PM_{10})
- Auxiliary boilers and freeze-protection HTF heaters (NO_X and PM_{10})
- Plant cooling tower (PM_{10} only, excluding water vapor)

For these process point sources, the pollutants that could contribute to a visible plume have been quantified for the maximum, gas-fired supplemental generation scenario (see Section 4.2.2.1). Fugitive and windblown dust emissions associated were not included in the VISCREEN analysis. The emission rates used as inputs to VISCREEN simulations for the SSEP represent potential maximum daily operating conditions for the project stationary stack. The PM_{10} and NO_x emission rates used in the visibility analysis are 10.35 grams per second (g/s) (1,971 pounds per day) and 4.92 g/s (937 pounds per hour), respectively. These would be the combined emissions of the gas-fired SSEP sources, operating simultaneously, in combination with the cooling tower particulate emissions. The stack height assumed in the VISCREEN model was 150 feet.

For terrain viewing backgrounds, the terrain was assumed to be dark and located as close to the observer and the plume as possible. The analysis used representative meteorological data from Phoenix Sky Harbor Airport, which is near the Project Area.

The VISCREEN model was first used to quantify the highest likelihood of a visible plume (based on the perceptibility threshold described above) using the set of meteorological parameters (wind speed, stability class, and wind direction) that are unfavorable for dispersion and that occur with a cumulative probability of 1% (99^{th} percentile worst dispersion conditions for a potential plume).

The VISCREEN model was also used to assess how frequently a plume is likely to be perceptible (based on the perceptibility threshold described above) at each of the areas of interest. The analysis focused on the meteorological conditions that would most likely contribute to visual impacts from project emissions. Five years of hourly meteorology data from Phoenix Sky Harbor Airport were used to characterize the range of conditions that occur with respect to the locations of an observer in each area compared to the SSEP. Because the impairment of visibility is unlikely during darkness, the analysis focused on conditions that were recorded during daylight hours.

Complete documentation of the VISCREEN analysis, including model inputs, assumptions, and results, is available in the *SSEP Air Quality Technical Report* (Farmer 2010).

4.2.3 No Action

Under the No Action alternative, BLM would continue to manage the land in the Project Area for livestock grazing and dispersed recreation use; and the lands adjacent to the Project Area for sand and gravel production, utility ROWs, livestock grazing, and dispersed recreation. Dust from the use of these lands would continue to contribute to the Maricopa County PM_{10} serious nonattainment area. Under the No Action alternative, the SSEP would not be developed, and existing air quality concerns in the Project Area would continue. The MCAQD would continue to work to bring emissions in the area into compliance with NAAQS. In the near future, the classification of the area as a serious nonattainment area for PM_{10} would continue.

4.2.4 Proposed Action

Direct impacts to air quality would result from vehicle exhaust emissions during construction, emissions from stationary sources (gas-fired supplemental electrical generation components, cooling towers, and emergency generator and fire water pumps) during operations, fugitive dust emissions associated with construction activities and travel on unpaved roads, and windblown dust associated with the removal of 3,400 acres of vegetation until such time as soils have recrusted and have returned to predisturbance stability levels.

4.2.4.1 PROJECT EMISSIONS

4.2.4.1.1 Summary of Emissions during Construction

Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles. In addition, fugitive dust emissions (PM_{10} and $PM_{2.5}$) during the construction of the SSEP would result from a variety of activities, including land clearing and excavation, road surface construction, and cut and fill operations (i.e., earth moving). Dust emissions can vary substantially from day-to-day depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A portion of the total fugitive dust emissions and construction vehicle exhaust emissions would result from construction vehicle traffic over the extensive improved plant road surfaces within the Project Area. Given the nature of dust emissions that may be generated during construction, and the stringent control measures required under county rules described in this section, impacts due to dust emissions would be of short duration and would be localized. Dust emissions that may occur due to high winds are unpredictable.

Maximum monthly emissions from construction of the SSEP are summarized in Table 4.4 and compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants. The proponent has committed to ensuring that construction emissions would not exceed major source thresholds for any criteria pollutant. At maximum construction levels, construction of the SSEP would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 8.8 tons per month (tpm) (0.12%) and 2.3 tpm (0.15%), respectively. Emissions of NO_x, CO, and VOCs would be 14.7 tpm (0.14% increase over current county emissions), 6.1 tpm (0.01% increase), and 1.6 tpm (0.01% increase), respectively.

Table 4.4 Summary of Maximum Monthly Construction Emissions – Proposed Action and Alternative A*

Emission Source Category[1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Proposed Action and Alternative A					
Earthmoving/construction operations[3]	8.20	1.70	0.0	0.0	0.0
Offroad construction equip. exhaust[4]	0.56	0.52	13.40	5.71	1.48
Construction mobile vehicle exhaust[5]	0.04	0.04	1.30	0.37	0.14
Total construction emissions	**8.8**	**2.3**	**14.7**	**6.1**	**1.6**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.12%**	**0.15%**	**0.14%**	**0.01%**	**0.01%**

Note: Maximum monthly construction emissions are based on the project construction schedule (Table 2.45) and include months when construction of Unit 1 and Unit 2 overlap.

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006; SCAQMD 1993.

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes stationary, temporary construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.4.1.2 Summary of Emissions during Operations

Emissions of criteria pollutants during operation of the SSEP would result from combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. In addition, the cooling tower would emit PM that originates as suspended solids in the water used for evaporative cooling. Dust emissions (PM_{10} and $PM_{2.5}$) during the operation of the SSEP would result from windblown dust generated from disturbed areas and fugitive dust due to vehicle travel on unpaved roads and other surfaces.

Most dust generated from the site would be controlled through mitigation. However, incidents of windblown dust are unpredictable and typically occur several times per year, most often during the mid-summer monsoon pattern. At such times, short-duration, windblown dust plumes in the region significantly impair visibility. It is expected that the SSEP would not contribute more to this phenomena than other dry desert or agricultural areas. The combination of measures (see Section 4.2.2.1.1) such as soil binder application and repeated soil watering to promote crust formation would make the Project Area less susceptible to release of windblown dust than native bare soil or the agricultural/residential areas near the Project Area. Consequently, these emissions were not considered in the operational phase modeling.

An overall summary of the maximum operational phase emission sources is provided in Table 4.5. These emissions represent the maximum gas-fired generation scenario for the SSEP. Maximum annual emissions are below both PSD and Title V major source thresholds. Facility-wide emissions of HAPs are below the major source thresholds of 10 tpy for individual HAP and 25 tpy for total combined HAPs. Operating limits on fuel input proposed by the facility would result in emission levels below the 100 tpy major source thresholds for NO_x, CO, and VOCs and below the 70 tpy major source threshold for PM_{10}. Operational limits on gas-fired operations that are consistent with the parameters used in this analysis would be implemented in the air quality permit in the form of enforceable limits on the facility-wide, annual, natural gas heat input capacity. Complete calculations of emissions, including an overall facility summary, are available in the SSEP *Air Quality Technical Report* (Farmer 2010).

Expected maximum annual emissions during operation of the proposed SSEP are compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants in Table 4.5. Operation of the SSEP at maximum levels would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 40.9 tpy (0.05%) and 22.2 tpy (0.13%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.05%.

Table 4.5 Maximum Annual Operational Phase Emissions for the SSEP – the Proposed Action

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC	HAP
250-MW HTF process heater	5.5	5.5	12.0	55.2	0.1	9.2	2.1
125-MW HTF process heater	2.8	2.8	6.1	28.0	0.0	4.6	1.1
30 MMBtu/hour auxiliary boilers (2x)	0.2	0.2	0.4	0.7	0.0	0.1	0.1
30 MMBtu/hour HTF freeze-protection heaters (2x)	0.5	0.5	9.4	11.3	0.0	0.3	0.2
1,500-kW diesel powered emergency generator	0.0	0.0	0.5	0.3	0.0	0.0	0.1

Table 4.5 Maximum Annual Operational Phase Emissions for the SSEP – the Proposed Action

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC	HAP
1,000-kW diesel powered emergency generator	0.0	0.0	0.4	0.2	0.0	0.0	0.0
300-hp fire water pump diesel engine (2×)	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Cooling towers (2×)	19.9	11.9	–	–	–	–	–
Plant vehicles on paved/unpaved roads	12.0	1.3	–	–	–	–	–
Proposed action total annual emissions	**40.9**	**22.2**	**28.9**	**95.8**	**0.1**	**14.2**	**3.5**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.05%**	**0.13%**	**0.02%**	**0.01%**	**0.00%**	**0.01%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment Area current NOx, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.4.2 CONTRIBUTIONS TO NAAQS

The NAAQS provide an appropriate context to assess air quality impacts from the project because they represent thresholds identified by EPA to protect public health. The fraction of the NAAQS concentrations that would be contributed by a conservative representation (maximum output and unfavorable meteorological conditions) of the project emissions for pollutants is summarized in Table 4.6. The following criteria pollutants do not currently exceed NAAQS: NO_x, CO, and SO_2. The SSEP, therefore, would not contribute to existing exceedances, nor would it lead to new exceedances. However, it would incrementally increase overall current emissions of those constituents by <0.01% to 0.5% (Table 4.6).

Table 4.6 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Proposed Action

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations ($\mu g/m^3$)[2]								
	PM_{10} 24-hour	PM_{10} Annual	$PM_{2.5}$ 24-hour	$PM_{2.5}$ Annual	NO_X Annual	NO_X 8-hour	NO_x 1-hour	VOCs 8-hour	CO 8-hour
Concentration associated with SSEP Emissions[1]	0.562	0.113	0.557	0.111	0.28	2.69	3.84	1.62	10.1
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.37%	0.23%	1.59%	0.20%	0.28%	n/a	n/a	n/a	0.10%
Buckeye background concentration[2,3]	158–192	53	No data	No data					
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5					

[1]Project emission rates assessed for conservative maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentration is 1.3 km from the project site.

[2]Buckeye monitoring station data range from 2005 to 2007 (Source: Arizona Department of Environmental Quality [ADEQ], Air Quality Annual Reports 2008, 2007, 2006).

[3]Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1.3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to existing exceedances in the area as reported in this table is a minimum.

The SSEP would be located in the Maricopa County PM_{10} nonattainment area. Exceedance of the 24-hour NAAQS occurs if two or more 24-hour PM_{10} readings exceed the standard of 150 micrograms per cubic meter ($\mu g/m^3$). Data from the Buckeye monitoring station, the closest monitoring station to the Project Area, indicate consistent exceedances of this standard. Between 2005 and 2007, the second maximum 24-hour PM_{10} concentration ranged from 158 to 192 $\mu g/m^3$ (see Table 4.6). The SSEP would contribute at most 0.562 $\mu g/m^3$ of PM_{10} during a 24-hour period. SSEP sources constitute a maximum of 0.37% of the 24-hour PM_{10} standard (see Table 4.6) and are predicted to occur close to the Project Area boundary. The SSEP would contribute no more than 0.113 $\mu g/m^3$ toward the annual PM_{10} NAAQS. The current annual average PM_{10} concentration at the Buckeye monitoring station is 53 $\mu g/m^3$ compared to the NAAQS of 50 $\mu g/m^3$. The data from the west Phoenix monitoring station are likely to underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix monitoring stations (see Table 4.6). Similarly, the SSEP would contribute at most 0.557 $\mu g/m^3$ of $PM_{2.5}$ during a 24-hour period. SSEP sources constitute a maximum of 1.59% of the 24-hour $PM_{2.5}$ standard (see Table 4.6).

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore, are unlikely to contribute to the existing exceedances of NAAQS.

The project would also be located in an 8-hour ozone nonattainment area, and therefore emissions of ozone precursors were also considered in this analysis. The SSEP would contribute, at most, an additional 2.69 $\mu g/m^3$ and 1.62 $\mu g/m^3$ to existing concentrations of NO_x and VOCs over an 8-hour period, respectively. However, 8-hour ozone background data at the Buckeye monitoring station are well below the NAAQS (see Chapter 3) and do not indicate any exceedances of ozone NAAQS between 2005 and 2008. Ozone exceedances occur in the more urbanized areas of Maricopa County. Therefore, emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

4.2.4.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

The VISCREEN model was used to evaluate the maximum potential impact over a single hour. The analysis conservatively assumed the most unfavorable meteorological conditions and that a low sun angle occurred simultaneously for each observer location. Complete VISCREEN model results are available in the *SSEP Air Quality Technical Report* (Farmer 2010). Table 4.7 summarizes the outputs for the VISCREEN modeling for the most adverse dispersion conditions and illustrates how these impacts are distance dependent. However, these conditions frequently occur at night when the visibility of plumes is not a concern.

Perception of a visible plume by a distant observer is more likely during early morning or late afternoon hours, when the sun is lowest in the sky. The closer the area of interest is to the SSEP, the higher the potential plume visibility is to an observer. Under the most adverse meteorological conditions, including nighttime hours, the model predicted that a plume could be visible at the Sonoran Desert National Monument, Signal Mountain Wilderness, Woolsey Peak Wilderness, North Maricopa Mountains Wilderness, Sierra Estrella Wilderness, Estrella Mountain Regional Park, and Buckeye Hills Regional Park. This analysis is based on significance thresholds identified for Class I areas (see Section 4.2.2.3). Under no conditions would a plume be visible from the South Maricopa Mountains Wilderness or the White Tank Mountain Regional Park. Plume visibility is a function of distance, wind patterns, and topography. To better evaluate the likelihood of significant plume visibility during daylight conditions, the VISCREEN model was operated with a data filter to predict the number of daylight hours per year, on average, when observers might see visible plumes.

Table 4.7 VISCREEN Analysis Results under most Unfavorable Meteorological Conditions

Class II Wilderness and Recreation Areas	Distance to SSEP (km)	Wind Vector	Sky Plume Visibility		Terrain Plume Visibility	
			ΔE	Contrast	ΔE	Contrast
Sonoran Desert National Monument	2.2	SE	**11.8–18.2**	**-0.2–0.25**	**6.2–49.3**	0.03–**0.18**
Signal Mountain Wilderness	34.3	WSW	0.6–1.6	-0.02–0.02	0.2–**2.2**	0.01–0.02
Woolsey Peak Wilderness	22.7	W	0.8–**2.8**	-0.03–0.03	0.9–**4.2**	0.03–0.05
North Maricopa Mountains Wilderness	4.9	SE	**5.9–16.5**	**-0.18–0.20**	**2.8–29.0**	0.02–**0.12**
South Maricopa Mountains Wilderness	28.2	SE	0.5–1.5	-0.02–0.02	0.2–1.9	0.00–0.02
Sierra Estrella Wilderness	22.5	E	1.0–**2.3**	-0.02–0.02	0.2–**3.6**	0.00–0.02
Estrella Mountain Regional Park	13.8	ENE	1.9–**4.6**	-0.05–0.05	1.8–**9.8**	0.04–**0.09**
White Tank Mountain Regional Park	43.5	N	0.1–0.3	0.00	0.0–0.3	0.00
Buckeye Hills Regional Park	8.9	NW	1.3–**2.4**	-0.03–0.03	0.5–**6.2**	0.00–0.03

Note: **Bolded** values exceed the perceptibility threshold (ΔE greater than 2.0 or contrast parameter greater than 0.05) and therefore indicate a likelihood of visibility from the recreation area.

Table 4.8 summarizes the frequency that the perceptibility threshold is likely to be exceeded during daylight hours only for each of the nine wilderness and recreation areas. The likelihood of seeing a visible plume from the SSEP would occur for 43 hours per year (0.5% of the time) at the Sonoran Desert National Monument and North Maricopa Mountains Wilderness, and for 73 hours per year (0.8% of the time) at the Buckeye Hills Regional Park. Note that the visibility of plumes would not necessarily extend for full days. Plumes would not be visible at any of the other wilderness or recreation areas. Note that Class II areas have no visibility protection under federal or state law.

Table 4.8 Frequency of Plume Visibility at Class II Wilderness and Recreation Areas

Class II Wilderness and Recreation Areas	Distance from SSEP	Percent of Values over Perceptibility Threshold[1]	Average No. of Hours/Year[2]
Sonoran Desert National Monument	2.2	0.49%	42.8
Signal Mountain Wilderness	34.3	None	None
Woolsey Peak Wilderness	22.7	None	None
North Maricopa Mountains Wilderness	4.9	0.49%	42.8
South Maricopa Mountains Wilderness	28.2	None	None
Sierra Estrella Wilderness	22.5	None	None
Estrella Mountain Regional Park (County)	13.8	None	None
White Tank Mountain Regional Park (County)	43.5	None	None
Buckeye Hills Regional Park (County)	8.9	0.83%	73

[1] From five years of Phoenix meteorological data, highest annual percentage of daylight hours when perceptibility threshold would be exceeded, specifically ΔE parameter above 2.0 and contrast parameter higher than 0.05.

[2] Calculated based on six hours per day of low-sun angle hours analyzed by VISCREEN. This information assumes only this 6-hour period per day would be affected.

4.2.5 Alternative A: Reduced Water Use (dry-cooled CST)

4.2.5.1 PROJECT EMISSIONS

4.2.5.1.1 Summary of Emissions during Construction

The nature and quantity of construction emissions would be the same under Alternative A compared to the Proposed Action (see Table 4.4) because the area of disturbance and peak construction plan would be the same.

4.2.5.1.2 Summary of Emissions during Operations

The nature of emissions during operations would be very similar under Alternative A compared to the Proposed Action. The elimination of cooling towers, however, would result in a 51% reduction of PM_{10} emissions and a 57% reduction in $PM_{2.5}$ emissions under Alternative A compared to the Proposed Action. In addition, emissions from all gas-fired electrical generation components would be reduced by 9% due to the reduced amount of fuel consumption under Alternative A compared to the Proposed Action (Table 4.9).

Maximum annual emissions during operations of Alternative A would result in an increase to current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 20.2 tpy (0.02%) and 9.5 tpy (0.05%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.02%.

Table 4.9 Maximum Annual Operational Phase Emissions for the SSEP – Alternative A

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAP
250-MW HTF process heater	5.0	5.0	10.9	50.2	0.0	8.4	1.9
125-MW HTF process heater	2.5	2.5	5.6	25.5	0.0	4.2	1.0
30-MMBtu/hour auxiliary boilers (2×)	0.2	0.2	0.4	0.7	0.0	0.1	0.1
30-MMBtu/hour HTF freeze-protection heaters (2×)	0.4	0.4	8.5	10.3	0.0	0.3	0.2
1,500-kW Diesel powered emergency generator	0.017	0.016	0.53	0.29	0.001	0.01	0.054
1,000-kW Diesel powered emergency generator	0.01	0.01	0.35	0.19	0.0004	0.001	0.037
300-hp fire water pump diesel engine (2x)	0.005	0.005	0.1	0.088	0.0002	0.002	0.038
Plant vehicles on paved/unpaved roads	12	1.3	–	–	–	–	–
Alternative A Total emissions annual emissions	**20.2**	**9.5**	**26.4**	**87.2**	**0.1**	**12.9**	**3.2**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.02%**	**0.05%**	**0.02%**	**0.01%**	**0.001%**	**0.00%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.5.2 CONTRIBUTIONS TO NAAQS

The nature of impacts on the current attainment status of NAAQS emissions during operations would be very similar under Alternative A compared to the Proposed Action. Due to the elimination of cooling towers, there would be a reduction in the contribution of the SSEP toward NAAQS for PM_{10} and $PM_{2.5}$. In addition, the concentrations of all other criteria pollutants would be reduced by 9% and would therefore be smaller contributors toward NAAQS. Under Alternative A, the SSEP would contribute at most 0.28 $\mu g/m^3$ of PM_{10} during a 24-hour period (compared to 0.562 $\mu g/m^3$ under the Proposed Action). SSEP sources would constitute a maximum of 0.2% of the 24-hour PM_{10} standard (Table 4.10), and would occur close to the Project Area boundary.

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore, are unlikely to contribute to the existing exceedances of NAAQS. The SSEP would contribute, at most, an additional 2.46 $\mu g/m^3$ and 1.48 $\mu g/m^3$ to existing concentrations of NO_x and VOCs in the area, respectively (9% less than the Proposed Action). As described under the Proposed Action, these emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

Table 4.10 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Alternative A

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations (µg/m³)[2]								
	PM_{10} 24-hour	PM_{10} Annual	$PM_{2.5}$ 24-hour	$PM_{2.5}$ Annual	NO_X Annual	NO_X 8-hour	NOx 1-hour	VOCs 8-hour	CO 8-hour
Scaling factor compared to Proposed Action	51%	51%	57%	57%	9%	9%	9%	9%	9%
Concentration associated with SSEP Emissions[1]	0.28	0.06	0.24	0.05	0.25	2.46	3.51	1.48	9.20
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.2%	0.1%	0.7%	0.1%	0.3%	n/a	n/a	n/a	0.1%
Buckeye background concentration[2,3]	158–192	53	No data	No data	=	=	=	=	=
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5	=	=	=	=	=

[1] Project emission rates assessed for conservative maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentration is 1.3 km from the project site.

[2] Buckeye monitoring station data range from 2005 to 2007 (Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006.)

[3] Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1.3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to existing exceedances in the area as reported in this table is a minimum.

4.2.5.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

Plume visibility associated with Alternative A would be the same or less than the impact described for the Proposed Action because combustion related emissions would be 9% less under Alternative A compared to the Proposed Action. The Proposed Action would result in a visible plume less than 1% of the time at three recreational areas in the vicinity. Under Alternative A, there would not be any vapor plumes associated with the cooling towers.

4.2.6 Sub-alternative A1: Photovoltaic

4.2.6.1 PROJECT EMISSIONS

4.2.6.1.1 Summary of Emissions during Construction

The nature of construction emissions would be the same under Sub-alternative A1 as under the Proposed Action (see Table 4.11) because the nature of construction (e.g., methods) would be the same. Maximum monthly emissions from construction of the SSEP under Sub-alternative A1 are summarized in Table 4.11 and compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants. At maximum construction levels, construction of the SSEP under Sub-alternative A1 would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 6.1 tpm (0.09%) and 1.4 tpm (0.1%), respectively. Emissions of NO_x, CO, and VOCs would result in less than 0.07% increases over current emission (Table 4.11).

Table 4.11 Summary of Maximum Monthly Construction Emissions – Sub-alternative A1

Emission Source Category[1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Earthmoving/construction operations[3]	4.8	1.1	–	–	–
Offroad construction equipment exhaust[4]	0.035	0.32	5.5	1.44	0.36
Construction mobile vehicle exhaust[5]	0.005	0.005	1.7	0.13	0.04
Total construction emissions	**6.1**	**1.4**	**7.2**	**1.57**	**0.40**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.09%**	**0.10%**	**0.07%**	**0.001%**	**0.002%**

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006 and SCAQMD 1993.

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes stationary, temporary construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); because the Project Area is not in the ozone nonattainment area, current NO_x, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.6.1.2 Summary of Emissions during Operations

Under Sub-alternative A1, there would not be any emissions of criteria pollutants resulting from direct operation of the plant. Dust emissions (PM_{10} and $PM_{2.5}$) during the operation of the SSEP would result from windblown dust generated from disturbed areas and fugitive dust due to vehicle travel on unpaved roads and other surfaces. Dust suppression would be achieved using the same measures described for the Proposed Action.

An overall summary of the maximum operational phase emission sources under Sub-alternative A1 is provided in Table 4.12. Complete calculations of emissions, including an overall facility summary, are available in the SSEP *Air Quality Technical Report* (Farmer 2010). Expected maximum annual emissions during operation of the SSEP are compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants in Table 4.12. Operation of the SSEP at maximum levels would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 15.8 tpy (0.009%) and 1.6 tpy (0.009%), respectively. There would be no emissions of other criteria pollutants.

Table 4.12 Maximum Annual Operational Phase Emissions for the SSEP – Sub-alternative A1

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAP
Plant vehicles on paved/unpaved roads	15.8	1.6	–	–	–	–	–
Sub-alternative A1 Total emissions annual emissions	15.8	1.6	–	–	–	–	–
Current Maricopa County emissions[1]	84,753	17,520	125,699	1,319,398	7,546	263,580	No data
Estimated increase in current emissions	0.02%	0.009%	0.00%	0.00%	0.00%	0.00%	0.00%

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area, current NO_x, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.6.2 CONTRIBUTIONS TO NAAQS

There are no point sources of emissions under Sub-alternative A1; therefore, the SSEP would not result in any substantive contribution to NAAQS under this sub-alternative.

4.2.6.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

There are no point sources of emissions under Sub-alternative A1, including no visible plumes of water vapor. As a result, the SSEP would not result in any visible plumes at any of the recreation areas evaluated under the other alternatives.

4.2.7 Alternative B: Reduced Footprint

4.2.7.1 PROJECT EMISSIONS

4.2.7.1.1 Summary of Emissions during Construction

The nature of construction emissions would be the same under Alternative B compared to the Proposed Action. However, construction emissions would persist for a shorter period of time (two fewer months) compared to the Proposed Action.

Maximum monthly emissions of construction-related criteria pollutants would be lower than under the Proposed Action (Table 4.13). These reductions are associated with less intensive construction activities during construction of a 125-MW power block compared to a 250-MW power block including less emission generating equipment. Compared to the Proposed Action, Alternative B would result in 3% fewer emissions of PM_{10}, 9% fewer emissions of $PM_{2.5}$, 34% fewer emissions of NOx, 39% fewer emissions of CO, and 34% fewer emissions of VOCs at maximum construction levels. Alternative B would still result in an increase over current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 8.6 tpm (0.12%) and 2.1 tpm (0.14%) respectively. Emissions of NO_x would result in an increase over current emissions of 9.7 tpm (0.09%).

Table 4.13 Summary of Maximum Monthly Construction Emissions – Alternative B

Emission Source Category [1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Earthmoving/construction operations [3]	8.20	1.70	0.0	0.0	0.0
Offroad construction equipment exhaust [4]	0.31	0.31	8.40	3.37	0.94
Construction mobile vehicle exhaust [5]	0.05	0.04	1.30	0.35	0.13
Total construction emissions	**8.6**	**2.1**	**9.7**	**3.7**	**1.1**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.12%**	**0.14%**	**0.09%**	**0.00%**	**0.01%**

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006; SCAQMD 1993

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes stationary, temporary construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM^{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.7.1.2 Summary of Emissions during Operations

The nature of emissions during operations would be very similar under Alternative B compared to the Proposed Action. The reduced capacity of the SSEP under Alternative B, however, would result in approximately 1/3 fewer operating emissions compared to the Proposed Action (Table 4.14). Maximum annual emissions during operations of Alternative B would result in an increase to current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 27.6 tpy (0.03%) and 15.1 tpy (0.09%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.02%.

Table 4.14 Maximum Annual Operational Phase Emissions for the SSEP – Alternative B

Source or Activity	Annual Potential to Emit, with Controls (tons/year)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAPs
125-MW HTF process heaters	5.6	5.6	12.2	56	0.06	9.2	2.12
30 MMBtu/hour auxiliary boilers (2×)	0.18	0.18	0.42	0.72	0.02	0.11	0.07
30 MMBtu/hour HTF freeze-protection heaters (2×)	0.46	0.46	9.38	11.3	0.02	0.28	0.17
1,000-kW diesel powered emergency generator (2×)	0.02	0.02	0.7	0.38	0.0008	0.002	0.074
300-hp fire water pump diesel engine (2×)	0.005	0.005	0.1	0.088	0.0002	0.002	0.038
Cooling towers (2×)	13.3	8.0	–	–	–	–	–
Plant vehicles on paved/unpaved roads	8.0	0.9	–	–	–	–	–
Alternative B total emissions annual emissions	**27.6**	**15.1**	**22.8**	**68.5**	**0.1**	**9.6**	**2.5**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.03%**	**0.09%**	**0.02%**	**0.01%**	**0.00%**	**0.00%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.7.2 CONTRIBUTIONS TO NAAQS

The nature of impacts on the current attainment status of NAAQS emissions during operations would be very similar under Alternative B compared to the Proposed Action. The reduced capacity of the SSEP under Alternative B would result in a reduction in concentrations associated with project emissions of approximately 1/3 (Table 4.15). Under Alternative B, the SSEP would contribute, at most, 0.38 $\mu g/m^3$ PM_{10} during a 24-hour period (compared to 0.562 $\mu g/m^3$ under the Proposed Action). SSEP sources constitute a maximum of 0.3% of the 24-hour PM_{10} standard (Table 4.15) and are predicted to occur close to the Project Area boundary.

Table 4.15 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Alternative B

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations ($\mu g/m^3$)[2]								
	PM_{10} 24-hour	PM_{10} Annual	$PM_{2.5}$ 24-hour	$PM_{2.5}$ Annual	NO_X Annual	NO_X 8-hour	NOx 1-hour	VOCs 8-hour	CO 8-hour
Scaling factor compared to Proposed Action	32%	32%	32%	32%	21%	21%	21%	32%	29%
Concentration associated with SSEP Emissions[1]	0.38	0.08	0.38	0.08	0.22	2.12	3.03	1.09	7.22
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.3%	0.2%	1.1%	0.1%	0.2%	n/a	n/a	n/a	0.1%
Buckeye background concentration[2,3]	158–192	53	No data	No data					
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5					

[1] Project emission rates assessed for conservative maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentration is 1.3 km from the project site.

[2] Buckeye monitoring station data range from 2005 to 2007 (Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006).

[3] Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1.3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to existing exceedances in the area as reported in this table is a minimum.

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore are unlikely to contribute to the existing exceedances of NAAQS.

The SSEP would contribute, at most, 2.12 $\mu g/m^3$ and 1.09 $\mu g/m^3$ over an 8-hour period toward NAAQS for NO_x and VOCs in the area, respectively. As described under the Proposed Action, these emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

4.2.7.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

Plume visibility associated with Alternative B would be the same or less than the impact described for the Proposed Action because combustion related emissions would be less under Alternative B compared to the Proposed Action. The Proposed Action would result in a visible plume less than 1% of the time at three recreational areas in the vicinity: Sonoran Desert National Monument, North Maricopa Mountains Wilderness, and Buckeye Hills Regional Park. There would also be a smaller likelihood of vapor plumes as compared to the Proposed Action.

4.2.8 Reduced Water Use Option–Brine Concentrator

The brine concentrator option would not result in any changes in air quality impacts under the Proposed Action or Alternative B because it would not require any additional area of construction disturbance nor a change in operation of equipment to run the brine concentrator.

4.2.9 Generation Tie Line Option

The implementation of the Gen-tie Line Option would not increase vehicle exhaust emissions during construction because no additional vehicles would be required compared to the proposed gen-tie line; nor would it affect emissions or emission plumes from stationary sources during operations because no equipment changes to the solar energy plant would occur. Therefore, there would be no additional emissions of criteria pollutants or HAPs from these sources if this option were selected.

The application of the Gen-tie Line Option would result in additional surface disturbance, which has the potential to increase fugitive and windblown dust emissions (PM_{10} and $PM_{2.5}$). If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land under each alternative. Using a total of 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Conservatively assuming that an increase in surface disturbance would be proportional to an increase in dust emissions, the application of the Gen-tie Line Option would increase emissions of PM_{10} and $PM_{2.5}$ no more than 0.56%, depending on the alternative. These emissions would be for the construction period only.

4.2.10 Potential Mitigation Measures

Mitigation of PM_{10} and $PM_{2.5}$ emissions during the construction phase may be warranted because the project is in a serious nonattainment area, and background data at the Buckeye monitoring station indicate exceedances of the NAAQS. These measures are in addition to those required by MCAQD 310 and A.A.C. R18-02 (see Table 4.1 and Section 4.2.2.1.1) and could include the following:

- Cease emission-producing construction activities during periods of NAAQS exceedances, which could include high wind events and inversions.
- Treat actively disturbed areas on the Project Area prior to foreseeable and/or predictable high wind events with a water or a dust palliative to reduce dust emissions.
- Pave, gravel, and/or apply dust palliative to all road surfaces on the Project Area.
- Treat actively disturbed areas on the Project Area as soon as practicable (as discrete phases of construction on each area are completed) with a dust palliative to reduce windblown dust emissions.
- Minimize land disturbance as much as practicable to accommodate project design and construction.
- Cover cargo area of trucks when hauling soil.
- Revegetate any disturbed land not used for the SSEP.
- Implement dust-suppression mitigation measures as practicable on off-site roads within approximately 2 miles of the Project Area to offset all or a portion of remaining construction emissions.
- Create and use a mandatory carpool and/or vanpool system for construction employees to reduce travel on roads and vehicle emissions.

The following potential mitigation measures could be implemented during operation of the SSEP:

- Create and use a mandatory carpool and/or vanpool system for employees to reduce travel on roads and vehicle emissions.

Emissions of NO_x and VOCs, ozone precursors, are unlikely to contribute to exceedances of the 8-hour ozone NAAQS because exceedances of this standard occur in the more urbanized areas of Maricopa County. Therefore, potential mitigation has not been identified for these pollutants.

4.2.11 Residual Impacts

If the mitigation described in Section 4.2.10 were implemented in full, the project would contribute fewer emissions from fugitive and windblown dust sources. These reductions cannot be quantified because they depend on site-specific conditions and event-specific level of application.

4.2.12 Short-term Uses versus Long-term Productivity

Construction of the SSEP would result in emissions that are below the major source thresholds for all criteria pollutants. Construction emissions would result in a short-term increase in emissions of criteria pollutants; however, these emissions would be less than 0.2% of current monthly emissions in Maricopa County. The pollutants of greatest concern are PM_{10} and $PM_{2.5}$ due to the location of the SSEP in the Maricopa County PM_{10} serious nonattainment area.

Operation of the SSEP under the Proposed Action and Alternative A would result in long-term emissions of criteria pollutants and an associated increase in concentration of these pollutants surrounding the Project Area for the 30-year life of the project, but at a lower level than during the construction phase. These emissions are less than 0.1% of the annual total for Maricopa County and would not exceed major source thresholds. Operation would also lead to visible plumes from several recreational and wilderness areas within 50 km of the SSEP during no more than 1% of daylight hours. These impacts would also persist for the life of the project. Operational emissions under Sub-alternative A1 would be substantially fewer because there are no point-source emissions under this alternative. As a result, there would be no visibility impacts associated with this alternative, including no visual plumes.

4.2.13 Irreversible and Irretrievable Commitments of Resources

Air quality impacts would persist during operation of the SSEP, but would cease relatively quickly following the closure of the project and final reclamation. Therefore, there would be no irreversible impacts on air quality in the area. However, the impacts to air quality during the operation of SSEP would constitute an irretrievable impact.

4.3 Climate Change

The State of Arizona is committed to the reduction of GHG emissions as a means of limiting the influence of human activities on climate change. In September 2006, the governor enacted EO 2006-13, which set the goal of reducing statewide GHG emissions to year 2000 levels by the year 2020, and to 50% below the 2000 level by 2040. Further, the state is a member of the Board of Directors for the Climate Registry, a nonprofit collaboration among North American states, provinces, territories, and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify, and publicly report GHG emissions into a single registry—supporting both voluntary and mandatory reporting programs and providing comprehensive, accurate data to reduce GHG emissions. Arizona, along with California and most western states, is also a member of the Western Climate Initiative, a multistate and international program promoting a regional cap-and-trade market to reduce North American GHG emissions, with a particular focus on the western region of North America.

As a renewable power-generation facility, the SSEP would help the State of Arizona achieve these GHG reduction goals and help the state prepare for any future regional or federal GHG emissions regulations or legislation. This section provides a review of the SSEP GHG emissions for both construction and operational phases.

Combustion sources utilizing carbon-based fuel are the single largest anthropogenic source of CO_2 emissions (EPA 2002). Within the general category of combustion sources, however, different methods of electricity generation can have widely differing GHG emissions per unit of power generation. Direct and avoided GHG emissions (expressed as metric tons of CO_2 equivalents, Mt CO_2e[1]) are considered in this analysis.

4.3.1 Regulatory Requirements, Mitigation and Monitoring Measures

The Project Area is located in an area that falls under the air permitting and jurisdiction of the MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal regulatory requirements under the Clean Air Act derived from Title 40 of the CFR and from county requirements contained in Regulations II and III of the Maricopa County Air Pollution Control Regulations. The statutory provisions in the CAA and all subsequent amendments are implemented in 40 CFR §§ 50–97. The CAA provides for the regulation of certain pollutants, including the GHG CO_2. For more information on these regulations and how they apply to the SSEP, please see Section 3.2 (Air Quality). The EPA delegates the authority to administer and enforce many of these regulations to individual states and agencies such as the MCAQD. In such cases, the delegated state agency may write equivalent or more stringent requirements into their own rules, or they can adopt the federal requirements by reference.

One such agency rule, MCAQD Rule 241 Permits for New Sources and Modifications to Existing Sources, provides control technology requirements for new sources and modifications to existing sources of air pollution requiring permits or permit revisions. This rule is applicable to all new and existing sources other than new major sources and major modifications to major sources. Although this rule only applies to criteria pollutants, the new source technology controls associated with the rule also affect the total GHG emissions associated with the project because efficiencies designed for criteria pollutants also result in reduced GHG emissions.

[1] Individual GHGs have different warming effects, and by convention each is compared to the warming effect of CO_2 through its global warming potential (GWP). For example, methane has a GWP of 21, which means that one metric ton of methane has the same global warming impact as twenty-one metric tons of CO^2. In this way, each greenhouse gas can be translated into metric tons of CO^2 equivalents (Mt CO_2e). Thus, one metric ton of methane is equal to 21 Mt CO_2e.

Under all action alternatives, the SSEP facility would have the flexibility to supply an amount of electricity not exceeding 25% of the gross generation of the plant (in terms of MWh) by gas-fired generation using co-fired boilers or HTF process heaters (see Section 2.5.2.2.5 for regulatory details concerning gas-fired generation).

40 CFR § 98 (Reporting of GHGs) requires annual monitoring, recordkeeping, and reporting of GHG emissions for the combustion processes at the SSEP facility. In addition to the CO_2 emissions that are tracked under 40 CFR § 75 (federal Acid Rain Program) this rule requires the calculation of nitrous oxide (N_2O) and methane (CH_4) GHG emissions. The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

4.3.2 Analysis Area and Analysis Assumptions

The climate change analysis for the SSEP focuses on a two-tiered analysis area. The first tier relates to emissions from construction, vegetation loss, and SSEP operations. The study of these emissions is limited to the Project Area because that is where the vegetation would be lost and where construction and operational activities would take place (although emissions from vegetation that is removed from the Project Area and decomposes in local landfills are included). The second tier relates to an analysis of the emissions intensity of the SSEP versus area grid electricity and its comparison to the relevant portion of the national electrical grid—an area spanning multiple states (Figure 3.2).

Three key assumptions are made in this analysis. The first assumption, applicable to emissions from vegetation decomposition, is that area landfills where the vegetation would be disposed of are not fitted with CH_4 recovery systems. These systems typically capture approximately 75% of methane coming off of the landfill and combust it for use in energy generation or other applications. Because it is not known in which landfill the removed vegetation would be disposed, the existence of a methane recovery system to capture vegetation methane emissions cannot be assumed. The second assumption, also applicable to emissions from vegetation decomposition, is that Project Area vegetation is largely creosotebush and that a negligible percentage of its vegetative biomass would be subject to protection under the Arizona Native Plant Law (see Sections 4.1.1 and 4.16 of this document). Thus, it is conservatively assumed for the purposes of this analysis that all Project Area vegetation would be cleared and sent to area landfills. The third assumption, applicable to emissions from SSEP operations, is based on the Internal Revenue Service regulations related to the ITC available to solar projects, which states that if the unit generates more than 25% of its output using natural gas, the facility is no longer considered eligible for the ITC. Therefore, it is assumed that a maximum of 25% of the SSEP's annual electricity generation would come from gas-fired sources.

In this analysis, net project contribution to or mitigation of a changed climate is evaluated using a proxy measure of net project lifetime net GHG emissions, measured in Mt CO_2e. Net positive project lifetime emissions are considered a net contribution to a changed climate, whereas net negative project lifetime emissions are considered a net mitigation of a changed climate. The rationale for this approach is outlined below.

The causes of climate change are global in nature, with human and natural contributions that are global in scale. In addition, the effects of climate change are also global in nature; although modeling work has been conducted in an attempt to understand the potential effects of global climate change on a particular region. This is because emissions of GHGs do not generally remain localized, but become well mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that

would produce or mitigate GHG emissions. The implication is that the SSEP cannot be said to contribute or mitigate a certain "amount" of climate change. However, as described above, the analysis of project net lifetime emissions is used to disclose the SSEP's net mitigation of a changed climate.

The following GHG emissions are considered in the SSEP lifetime emissions analysis:

- Methane emissions from the decay of removed vegetation in area landfills
- The lost capacity of removed vegetation to sequester carbon in the future
- CO_2, methane, and N_2O emissions from diesel and gasoline fuel combustion in construction vehicles and equipment during SSEP construction activities
- CO_2, methane, and N_2O emissions from diesel, gasoline, and natural gas fuel combustion in SSEP vehicles and equipment during SSEP operations
- Emissions avoided from the generation of renewable electricity versus emissions from an equivalent amount of existing grid electricity

These GHG emissions, considered over the 30-year lifetime of the SSEP, are summed to yield a total value for net lifetime SSEP GHG emissions.

GHG emissions sources in this study are limited to emissions sources that are located within the confines of the Project Area. This limit was drawn to maintain the relevancy of this analysis to the SSEP. For example, one could include any number of indirect GHG emissions sources, such as the GHG emissions resulting from transportation to the Project Area or from the manufacture and transportation of construction equipment to the Project Area; however, such an approach would include a multitude of sources with an ever further degree of removal from the SSEP. The limitation of this analysis to emissions occurring in the Project Area maintains its relevancy to the SSEP as a decision-making tool.

The only exception to the Project Area limitation described above is the inclusion of GHG emissions from the landfill decay of Project Area vegetation. Although these emissions occur at the landfill in which the vegetation is placed, and not in the Project Area, they are a result of the clearing of vegetation that is itself located in the Project Area. Sufficient data were available to conclude that the relationship between the clearing of Project Area vegetation and GHG emissions from the decay of this vegetation was sufficiently close as to warrant the inclusion of this emissions source in the GHG analysis. Another potential exception would be increased employee travel to the Project Area; however, the relationship in this case is less direct because factors such as commuting distance, vehicle type, fuel type, and carpooling practices are not known and are not under the control of the SSEP and its operators.

Unless noted otherwise, all data in this section are drawn from the *SSEP Air Quality Technical Report* (Farmer 2010).

4.3.3 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue. No acres of vegetation would be cleared, Project Area vegetation would continue to sequester CO_2, there would be no project construction or operational phase GHG emissions, and no renewable energy would be generated.

Livestock grazing in the Project Area would continue in two allotments (one authorized and one ephemeral) that are grazed infrequently. Limited vehicle use in the Project Area would also continue. The Project Area includes approximately 13.1 miles of roads, and it is currently used infrequently by hikers, hunters, and birders. Motor vehicle use of this road system is also infrequent. Although livestock grazing

and motor vehicle activities do involve GHG emissions, emissions levels are likely small and data are not available to accurately quantify them. Therefore emissions from these sources are not considered in this analysis.

Project Area vegetation would continue to sequester CO_2, and over the 30-year lifetime of the SSEP, this vegetation would sequester an estimated 23,554 Mt CO_2e. Because this biosequestration of CO_2 is a naturally occurring feature of the Project Area, it is not considered a net mitigation of climate change. However, loss of this biosequestration capacity is considered as an impact area under the Proposed Action and the subsequent action alternatives and options. GHG emissions under the No Action alternative are summarized in Table 4.16.

Table 4.16 GHG Emissions – No Action Alternative

Activity Name	GHG Emissions (Mt CO_2e)
Landfill of vegetation	0
Lost biosequestration capacity of vegetation (30 year)	0
Construction activities	0
SSEP operations	0
Emissions savings from renewable energy	0
Total No Action emissions	**0**

4.3.4 Proposed Action

4.3.4.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

The Proposed Action would result in GHG emissions from SSEP construction, Project Area vegetation loss, and SSEP operations.

Construction activities under the Proposed Action would consist of clearing the Project Area of vegetation and operating earthmoving construction equipment and other construction vehicles and stationary equipment. This construction equipment would be operated to grade the Project Area, prepare drainage features, lay foundations for SSEP structures, construct the structures, and install major SSEP equipment. During construction, vegetation would be permanently removed from approximately 3,569 acres, and would be temporarily removed from (or disturbed on) an additional 31 acres. Construction equipment for both the 125-MW and 250-MW units would be operated for 25 months over the 39-month construction and commissioning timeframe (Farmer 2010, Appendix A). As construction equipment is operated, it produces GHG emissions through the combustion of gasoline and diesel fuels.

Once the Project Area vegetation has been cleared, it would be sent to area landfills where its decay would result in methane GHG emissions that would not otherwise occur. Finally, because Project Area vegetation would be suppressed during the SSEP's 30-year lifetime, its capacity to sequester CO_2 would be lost. This lost biosequestration capacity would result in a lost capture of CO_2 that is treated as the equivalent of a new emission of GHGs relative to the No Action alternative. Construction, vegetation landfill, and lost biosequestration GHG emissions for the 125-MW and 250-MW units are summarized in Tables 4.17 and 4.18, respectively.

Table 4.17 125-MW Construction GHG Emissions – Proposed Action

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,206 acres	2,139
Lost biosequestration capacity of vegetation (30 years)	1,196 acres	7,893
Construction: earthmoving equipment	98,550 hours	2,424
Construction: vehicles and stationary equipment	93,425 hours	2,084
Total 125-MW construction emissions		**14,540**

Table 4.18 250-MW Construction GHG Emissions – Proposed Action

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	2,394 acres	4,245
Lost biosequestration capacity of vegetation (30 years)	2,373 acres	15,662
Construction: earthmoving equipment	114,875 hours	2,967
Construction: vehicles and stationary equipment	68,450 hours	1,674
Total 250-MW Construction Emissions		**24,547**

Operational GHG emissions under the Proposed Action would consist of 1) emissions from natural gas combustion for SSEP co-fired HTF process heaters or steam boilers, auxiliary boilers, and HTF freeze-protection heaters; 2) emissions from diesel and gasoline fuel combustion for SSEP vehicles and emergency equipment; and 3) emissions from the leakage of the switchgear inert gas sulfur hexafluoride[2] (SF_6) (a GHG 23,900 times more potent than CO_2).

SSEP operational GHG emissions for the 125-MW and 250-MW units are summarized in Tables 4.19 and 4.20, respectively. These emissions have been evaluated for the 30-year lifetime of the SSEP. Operational GHG emissions over the life of the project for both the 125-MW and 250-MW block would range from 485,502 Mt CO_2e to 6,845,955 Mt CO_2e. The maximum emissions assume that the SSEP would generate 25% of the total electricity output from combustion of natural gas. The minimum emissions required to operate the SSEP would consist of those associated with the auxiliary boiler, the HTF freeze protection heater, the leakage of SF_6, and plant vehicles.

[2] Because the decision of whether to use SF_6 at the SSEP has not yet been finalized, the conservative assumption was made that the gas would be used. Leakage rates were estimated based on a similar project (Farmer 2010).

Table 4.19 125-MW Operational GHG Emissions (30-year) – Proposed Action

Activity Name	Source Data[1]	GHG Emissions ($Mt\ CO_2e$)
Natural gas augmented power production	Up to 1,327,000 MMBtu/year	2,118,210
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	125-MW scale	303
Diesel emergency generator	1,341 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	113,555 miles/year	2,706
Maximum total 125-MW operational emissions		**2,362,320**
Minimum total 125-MW operational emissions[1]		**242,409**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Table 4.20 250-MW Operational GHG Emissions (30-year) – Proposed Action

Activity Name	Source Data[1]	GHG Emissions ($Mt\ CO_2e$)
Natural gas augmented power production	Up to 2,655,000 MMBtu/year	4,238,010
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	250-MW scale	606
Diesel emergency generator	2,012 hp	2,004
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	122,680 miles/year	3,087
Maximum total 250-MW operational emissions		**4,483,635**
Minimum total 250-MW operational emissions[1]		**243,093**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

SSEP construction and vegetation loss GHG emissions can be added to the 30-year operational GHG emissions, yielding the total lifetime SSEP GHG emissions under the Proposed Action (Table 4.21).

Table 4.21 Summary of SSEP Lifetime GHG Emissions – Proposed Action

Activity Name	GHG Emissions ($Mt\ CO_2e$)
125-MW unit construction (including vegetation loss)	14,540
250-MW unit construction (including vegetation loss)	24,556
Maximum 125-MW unit operation	2,362,320
Minimum 125-MW unit operation	242,409
Maximum 250-MW unit cperation	4,483,635
Minimum 250-MW unit operation	243,093
Maximum total SSEP 30-year GHG emissions	**6,885,050**
Minimum total SSEP 30-year GHG emissions	**524,598**

Note: Individual values may not sum to the total due to rounding error.

The SSEP's net mitigation of climate change under the Proposed Action was determined by comparing the SSEP lifetime GHG emissions given in Table 4.21 to GHG emissions from grid electricity. GHG emissions from grid electricity, and how they relate to SSEP electricity under the Proposed Action, are discussed below.

4.3.4.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID

Under the Proposed Action, the SSEP is expected to produce 1,155,000 MWh of electricity per year, assuming 25% generation from gas co-firing (see Chapter 2, Table 2.15), or 34,650,000 MWh over its 30-year lifetime. When comparing GHG emissions intensity[3] to other sources of electricity, by EPA convention, only GHG emissions from plant fuel combustion for energy generation are considered (EPA 2008). Therefore, for the SSEP GHG emissions intensity, only GHG emissions from the combustion of natural gas in the co-fired HTF heaters or co-fired boilers ("Natural gas augmented power production" in Tables 4.19 and 4.20) are considered: 6,356,220 Mt CO_2e over the 30-year lifetime of the SSEP. This gives an emissions intensity of 404.4 pounds of CO_2e/MWh for the SSEP.

The GHG emissions intensity of the existing local grid electricity was assessed using the appropriate EPA eGRID subregion. EPA defined these subregions to represent portions of the power grid that have similar emissions and generation-resource mix characteristics, and that may be partially isolated by transmission constraints. However, these subregions also reflect the interconnected nature of the electrical grid, which spans county, state, and other geopolitical boundaries.

The Project Area and its associated analysis area are located in the Arizona New Mexico Western Electricity Coordinating Council (AZNM WECC) southwest subregion (see Figure 3.2). GHG emissions intensities of electricity for the SSEP and the existing AZNM WECC southwest eGrid subregion are given in Table 4.22.

Table 4.22 EPA AZNM WECC Southwest eGRID Subregion and SSEP GHG Emissions Intensities[1] of Electricity – Proposed Action

	Carbon Dioxide Equivalents (pounds/MWh)
SSEP	404.4
AZNM WECC southwest eGrid subregion (grid electricity)	1,317.98

Resources that generate electricity in AZNM WECC southwest subregion consist primarily of coal (46% of total generation), natural gas (32%), nuclear (16%), hydro (4%), and geothermal (2%) (EPA 2008). Renewable energy sources such as hydro, geothermal, wind, and solar make up 6% of the total subregion generation mix, with solar in particular contributing 0.0086% of total generation. Total annual electricity generation in this subregion is 157,546 GWh.

Existing generation levels of renewable energy within the AZNM WECC southwest eGrid subregion and the changes that would occur under the Proposed Action are summarized in Table 4.23.

[3] When discussing the GHG emissions of electricity, the term "emissions intensity" refers to the amount of GHGs emitted per unit of electricity generated. By convention, the only GHGs used to calculate this figure are GHGs emitted from the combustion of fuel directly involved in the generation of the electricity. For example, a coal-fired power plant would include emissions from the burning of coal in its GHG emissions intensity calculation, but it would not include emissions from equipment used to move the coal within the site.

Table 4.23 AZNM WECC Renewable Energy Mix With and Without the SSEP – Proposed Action

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,608	12.2%
Solar energy (GWh/year)	13.5	1,169	8,524.6%

Given the emissions intensity of AZNM WECC southwest grid electricity of 1,317.98 pounds of CO_2e/MWh (see Table 4.22) and assuming the consumption of an amount of grid electricity equal to the SSEP's annual energy output of 1,155,000 MWh over its 30-year lifetime, the GHG emissions from the consumption of an equivalent amount of AZNM WECC southwest grid electricity over 30 years would total 20,714,872 Mt CO_2e. This value assumes that if the SSEP were not built, its electricity output would not be available and grid electricity would be consumed instead. By building the SSEP under the Proposed Action, 20,714,872 Mt CO_2e of GHG emissions from grid electricity would be avoided.

In contrast, construction of the SSEP under the Proposed Action would result in 6,896,657 Mt CO_2e of GHG emissions for the lifetime of the SSEP. SSEP net lifetime GHG emissions are calculated as the sum of SSEP lifetime GHG emissions and the avoided GHG emissions from 30 years of grid electricity at 1,155,000 MWh per year (Table 4.24).

Table 4.24 SSEP Net Lifetime GHG Emissions – Proposed Action

SSEP lifetime GHG emissions (Mt CO_2e)	6,885,050
Avoided GHG emissions from AZNM WECC Grid Electricity (Mt CO_2e)	-20,714,872
Proposed Action SSEP net lifetime GHG emissions (Mt CO_2e)	**-13,829,822**

4.3.5 Alternative A: Reduced Water Use (dry-cooled CST)

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be constructed using a dry-cooling technology rather than the wet-cooling considered under the Proposed Action. Because no water would be used for cooling, consumptive evaporative losses would be considerably lower under this alternative than under the other action alternatives.

4.3.5.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

Under Alternative A, GHG emissions from construction would not change; however, long-term and short-term vegetation loss would be reduced by approximately 9 acres and 2 acres, respectively, due to the need for fewer groundwater well sites. SSEP total construction and vegetation loss GHG emissions under Alternative A are shown in Tables 4.25 and 4.26, below.

Table 4.25 125-MW Construction GHG Emissions – Alternative A

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,204 acres	2,135
Lost biosequestration capacity of vegetation (30 years)	1,194 acres	7,881
Construction: earthmoving equipment	98,550 hours	2,424
Construction: vehicles and stationary equipment	93,425 hours	2,084
Total 125-MW construction emissions		**14,524**

Table 4.26 250-MW Construction GHG Emissions – Alternative A

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	2,386 acres	4,232
Lost biosequestration capacity of vegetation (30 years)	2,367 acres	15,623
Construction: earthmoving equipment	114,875 hours	2,976
Construction: vehicles and stationary equipment	68,450 hours	1,674
Total 250-MW construction emissions		**24,505**

Additionally, less efficient dry cooling would allow less energy production from the (same sized) solar field than under the wet-cooled Proposed Action. Total solar generation would be approximately 9% less than the anticipated generation under the Proposed Action, or approximately 1,051,050 MWh per year. Because total electricity generation would be reduced, the maximum level of natural gas allowed for electricity generation under the SSEP air permit would also be reduced to 3,623,620 MMBtu. This reduction in the maximum level of allowed natural gas means a reduction in maximum SSEP-operational GHG emissions to 6,273,885 Mt CO_2e under Alternative A relative to the Proposed Action (see Tables 4.19 and 4.20), as shown in Tables 4.27 and 4.28 below. The minimum GHG emissions from the SSEP under Alternative A would be the same as the Proposed Action at 485,502 Mt CO_2.

Table 4.27 125-MW Operational GHG Emissions (30-year) – Alternative A

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 1,207,570 MMBtu/year	1,927,560
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	125-MW scale	303
Diesel emergency generator	1,341 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	113,555 miles/year	2,706
Maximum total 125-MW operational emissions		**2,171,670**
Minimum total 125-MW operational emissions[1]		**242,409**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Table 4.28 250-MW Operational GHG Emissions (30-year) – Alternative A

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 2,416,050 MMBtu/year	3,856,590
Auxiliary boiler and HTF freeze-protection heater	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage	250-MW scale	606
Diesel emergency generator	2,012 hp	2,004
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles	122,680 miles/year	3,087
Maximum total 250-MW operational emissions		**4,102,215**
Minimum total 250-MW operational emissions[1]		**243,093**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Adding SSEP GHG emissions from construction and vegetation loss to the 30-year operational GHG emissions yields the total lifetime SSEP GHG emissions under Alternative A (Table 4.29).

Table 4.29 Summary of SSEP Lifetime GHG Emissions – Alternative A

Activity Name	GHG Emissions (Mt CO_2e)
125-MW unit construction (including vegetation loss)	14,524
250-MW unit construction (including vegetation loss)	24,505
125-MW unit operation	2,171,670
250-MW unit operation	4,102,215
Maximum total SSEP 30-year GHG emissions	**6,312,914**
Minimum total SSEP 30-year GHG emissions	**524,531**

4.3.5.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID – ALTERNATIVE A

The changes to the SSEP's electrical output and GHG emissions described above would influence the SSEP's contribution of renewable energy to the local grid, relative to the Proposed Action (see Table 4.23). However, because the SSEP's electrical output and GHG emissions from natural gas-augmented power production would both be reduced by 9% under Alternative A, the SSEP's emissions intensity (see Section 4.3.4.2) of electricity would be unchanged relative to the Proposed Action (see Table 4.22). The SSEP's contribution of renewable energy to the local grid under Alternative A is described in Table 4.30.

Table 4.30 AZNM WECC Renewable Energy Mix with and without the SSEP – Alternative A

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,504	11.1%
Solar energy (GWh/year)	13.5	1,065	7,757.4%

Finally, SSEP net lifetime GHG emissions—the difference between SSEP lifetime GHG emissions and the GHG emissions from an equivalent amount of grid electricity (see the discussion preceding Table 4.24)—would be changed relative to the Proposed Action (see Table 4.27) for two reasons. First, reductions to SSEP operational emissions under Alternative A (Tables 4.27 and 4.28) would reduce SSEP lifetime GHG emissions. Second, reductions to SSEP electrical output would reduce the equivalent amount of grid electricity considered over 30 years. SSEP net lifetime GHG emissions under Alternative A are presented in Table 4.31.

Table 4.31 SSEP Net Lifetime GHG Emissions – Alternative A

SSEP lifetime GHG emissions (Mt CO_2e)	6,312,914
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	-18,850,534
Alternative A SSEP net lifetime GHG emissions (Mt CO_2e)	**-12,537,620**

4.3.6 Sub-alternative A1: Photovoltaic

Sub-alternative A1 was developed primarily in response to comments on the draft EIS concerning consumptive water use; however, this alternative also reduces the level of impacts to other resources due to its smaller footprint. Under this sub-alternative, the SSEP would use PV technology to generate electricity. This technology only requires incidental water use and does not require the use of natural gas. For a detailed explanation of Sub-alternative A1, refer to Section 2.7.

4.3.6.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

The nature of construction under this sub-alternative would be similar to the Proposed Action and would result in GHG emissions from construction. The area cleared during construction under Sub-alternative A1 would be 1,933 acres, 46% less than the 3,600 acres that would be cleared under the Proposed Action (Table 4.32). This would result in the emissions of 16,152 Mt CO2e over the life of the project due to the removal of vegetation and the loss of vegetative biosequestration capacity, 47% less emissions than under the Proposed Action. There would be 260,680 fewer construction hours under Sub-alternative A1 than under the Proposed Action, resulting in 6,139 Mt CO2e GHG emissions, 67% less than the emissions associated with vehicles and equipment under the Proposed Action.

Table 4.32 Construction GHG Emissions – Sub-alternative A1

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,933 acres	3,427
Lost biosequestration capacity of vegetation (30 years)	1,928 acres	12,724
Construction: earthmoving equipment	75,460 hours	2,231
Construction: vehicles and stationary equipment	39,160 hours	788
Total construction emissions		**19,171**

Additionally, there would be fewer GHG emissions during operation under Sub-alternative A1 than under the Proposed Action due to the sub-alternative's lack of natural gas supplemental power, auxiliary boiler and HTF freeze-protection heaters, diesel emergency generators, and water pumps. The operational GHG emissions would result from plant vehicle emissions and leakage of SF6 associated with switchgears. Total operational emissions for the life of the project would be 6,033 Mt CO2e, approximately 99.9% less than operational emissions associated with the Proposed Action (Table 4.33).

Table 4.33 Operational GHG Emissions (30-year) – Sub-alternative A1

Activity Name	Source Data	GHG Emissions ($Mt\ CO_2e$)
SF_6 switchgear inert gas leakage	300 MW Generation Capacity	729
Plant vehicles	140,190 miles/year	5,304
Total 125-MW operational emissions		**6,033**

Total construction and operation emissions over the life of the project would be 25,204 Mt CO2e under Sub-alternative A1, which is less than 1% of the total emissions (construction and operations) that would result from the project under the Proposed Action (Table 4.34).

Table 4.34 Summary of SSEP Lifetime GHG Emissions – Sub-alternative A1

Activity Name	GHG Emissions ($Mt\ CO_2e$)
Construction (including vegetation loss)	19,171
Operation	6,033
Total SSEP 30-year GHG emissions	**25,204**

4.3.6.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID – SUB-ALTERNATIVE A1

Under Sub-alternative A1, the SSEP would produce at least 775,000 MWh of electricity per year. Using the EPA criteria for calculating carbon intensity associated with electrical generation (see Section 4.3.4.2 for details), the SSEP under Sub-alternative A1 would have a carbon intensity of 0 pound of CO2e/MWh of production, compared to 1,318 pounds of CO2e/MWh for the AZNM WECC southwest eGrid subregion (i.e., the grid to which the SSEP would feed).

Existing generation levels of renewable energy within the AZNM WECC southwest eGrid subregion and the changes that would occur under Sub-alternative A1 are summarized in Table 4.35. The SSEP under Sub-alternative A1 would result in an 8.2% increase in all renewable energy and a 5,720% increase in solar energy contributing to the AZNM WECC subregion grid.

Table 4.35 AZNM WECC Renewable Energy Mix with and without the SSEP – Sub-alternative A1

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,225	8.2%
Solar energy (GWh/year)	13.5	789	5,720%

Construction and operation of the SSEP under Sub-alternative A1 would result in 25,203 Mt CO2e over the life of the project. In contrast, an equivalent amount of electrical production from the AZNM WECC southwest grid would result in 13,899,589 Mt CO2e over 30 years. These emissions are avoided through the construction of the SSEP, assuming that if the SSEP were not built, its electricity output would not be available and grid electricity would be consumed instead. Including these avoided GHG emissions, the net lifetime emissions of the SSEP under Sub-alternative A1 would be –13,874,386 Mt CO2e, which is less than 1% fewer emissions than the emissions associated with the Proposed Action (Table 4.36).

Table 4.36 SSEP Net Lifetime GHG Emissions – Sub-alternative A1

SSEP lifetime GHG emissions (Mt CO_2e)	25,203
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	−13,899,589
Sub-alternative A1 SSEP net lifetime GHG emissions (Mt CO_2e)	**−13,874,386**

4.3.7 Alternative B: Reduced Footprint

Under Alternative B, the SSEP would consist of two independent, concentrated solar electric generating facilities, each with nominal net electrical outputs of 125 MW (for a total of 250 MW), rather than 375 MW considered under the Proposed Action.

The main project footprint under Alternative B would require the permanent removal of vegetation on approximately 2,343 acres, versus approximately 3,568 acres under the Proposed Action. An additional 30 acres of vegetation would be removed or disturbed on a temporary basis, versus approximately 31 acres under the Proposed Action. Total solar generation would be approximately 33% less than the anticipated generation under the Proposed Action, or 770,000 MWh.

4.3.7.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

Because Alternative B would involve a smaller project footprint with less electricity generation capacity, there would be a number of differences in the construction, vegetation loss, and SSEP operational GHG emissions between this alternative and the Proposed Action. These differences are:

- a reduction in the acres of vegetation cleared, which would result in less vegetation being sent to area landfills (and therefore reduced GHG emissions from the decay of this vegetation) and less lost biosequestration capacity;
- a reduction in the SSEP construction time, due to less construction activity needed to build two 125-MW units instead of one 125-MW and one 250-MW unit, which would result in less GHG emissions from construction activities;
- a reduction in SSEP operational emissions from natural gas used to augment power production, due to the reduced electricity output and SSEP air permit restrictions, which would result in a reduction of GHG emissions from natural gas combustion; and
- a smaller amount of required operational support equipment and vehicles due to the reduced unit size from 250-MW to 125-MW, which would result in a reduction of SSEP operational emissions.

SSEP construction GHG emissions (including vegetation-related emissions) under Alternative B are shown in Table 4.37. Alternative B construction activities and emissions for the second 125-MW unit were scaled based on the Proposed Action's construction vehicle operation time of 25 months, versus 16 months of construction under Alternative B. A construction time of 16 months for the second 125-MW unit under Alternative B was assumed based on the 2 month reduction in construction time on the parabolic troughs and a 7 month reduction in construction time on the power blocks.

Table 4.37 Construction GHG Emissions – Alternative B

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,167 acres	2,070
Lost biosequestration capacity of vegetation (30 years)	1,148 acres	7,574
Construction: earthmoving equipment	68,296 hours	1,728
Construction: vehicles and stationary equipment	51,800 hours	1,203
125-MW unit 2 total construction emissions	n/a	12,575
125-MW unit 1 construction (unchanged from the proposed action)	n/a	14,540
Total construction emissions – Alternative B	**n/a**	**27,114**

SSEP operational GHG emissions under Alternative B are shown in Table 4.38. Minimum GHG emissions would be 7.5% less than the Proposed Action at 484,818 Mt CO2e; however, maximum GHG emissions would be 31% less than the Proposed Action at 4,724,640 Mt CO2e.

Table 4.38 125-MW Operational GHG Emissions (30-year) – Alternative B

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 1,327,500 MMBtu/year	2,118,210
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	250-MW scale	303
Diesel emergency generator	2,012 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	122,680 miles/year	2,706
Single 125-MW unit operational emissions		2,362,320
Maximum total operational emissions – Alternative B		**4,724,640**
Minimum total operational emissions – Alternative B		**484,818**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Adding SSEP GHG emissions from construction and vegetation loss to the 30-year operational GHG emissions yields the total lifetime SSEP GHG emissions under Alternative B, as shown in Table 4.39.

Table 4.39 Summary of SSEP Lifetime GHG Emissions – Alternative B

Activity Name	GHG Emissions (Mt CO_2e)
125-MW Unit 1 construction (including vegetation loss)	14,540
125-MW Unit 2 construction (including vegetation loss)	12,575
Maximum 125-MW Unit 1 operation	2,362,320
Minimum 125-MW Unit 1 operation	242,409
Maximum 125-MW Unit 2 operation	2,362,320
Minimum 125-MW Unit 2 operation	242,409
Maximum total SSEP 30-year GHG emissions	**4,751,754**
Minimum total SSEP 30-year GHG emissions	**511,933**

Note: Individual values may not sum to the total due to rounding error.

4.3.7.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID

The changes to the SSEP's electrical output and GHG emissions described above would influence the SSEP's contribution of renewable energy to the local grid, relative to the Proposed Action (see Table 4.23). However, because the SSEP's electrical output and GHG emissions from natural gas-augmented power production would both be reduced by 33% under Alternative B, the SSEP's emissions intensity (see Section 4.3.4.2) of electricity would be unchanged relative to the Proposed Action (see Table 4.22). The SSEP's contribution of renewable energy to the local grid under Alternative B is described in Table 4.40.

Table 4.40 AZNM WECC Renewable Energy Mix with and without the SSEP – Alternative B

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,223	8.1%
Solar energy (GWh/year)	13.5	784	5,683.1%

Finally, net lifetime GHG emissions for SSEP —the difference between SSEP lifetime GHG emissions and the GHG emissions from an equivalent amount of grid electricity (see the discussion preceding Table 4.24)—would change relative to the Proposed Action (see Table 4.24) for two reasons. First, reductions to SSEP construction emissions (Table 4.37) and operational emissions (Table 4.38) under Alternative B result in a reduction in SSEP lifetime GHG emissions. Second, reductions to SSEP annual electrical output would result in a reduction in the equivalent amount of grid electricity considered over 30 years. SSEP net lifetime GHG emissions under Alternative B are presented in Table 4.41.

Table 4.41 SSEP Net Lifetime GHG Emissions – Alternative B

SSEP lifetime GHG emissions (Mt CO_2e)	4,751,754
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	-13,809,915
Alternative A SSEP net lifetime GHG emissions (Mt CO_2e)	**-9,058,160**

4.3.8 *Reduced Water Use Option–Brine Concentrator*

The use of a brine concentrator would not affect SSEP construction or operational GHG emissions, and it would not affect SSEP electricity production. As such, the brine concentrator option would not affect the climate change contribution of any of the SSEP alternatives.

4.3.9 *Generation Tie Line Option*

The application of the Gen-tie Line Option would not affect SSEP electricity production, operational GHG emissions, or construction GHG emissions under any action alternative. Potential GHG emissions from this option would consist of short-term and long-term vegetation loss caused by additional surface disturbance.

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land under each alternative. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance

for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Conservatively assuming that an increase in surface disturbance would be proportional to an increase in GHG emissions, the application of the Gen-tie Option would increase total emissions of GHGs no more than 0.56% depending on the alternative.

4.3.10 Potential Mitigation Measures

Under all action alternatives, the SSEP would have a net lifetime GHG emissions level of less than zero (see Table 4.40), meaning that over its lifetime, the SSEP would act to reduce GHG emissions levels. Thus, because the SSEP would displace grid electricity with renewable electricity, the SSEP would mitigate future climate change relative to the No Action alternative.

Because climate change is a relatively new and evolving field, no BMPs have been identified with respect to this resource. However, some mitigation measures that could be applied to further reduce GHG emissions are discussed below.

4.3.10.1 COMPOST CLEARED VEGETATION TO REDUCE METHANE EMISSIONS IN LANDFILL

Some or all vegetation (as practicable) cleared from the site could be composted or used onsite as mulch rather than taken to a landfill. This would reduce or eliminate (depending on the practicable portion mulched) the methane emissions associated with anaerobic decomposition of plant material at a landfill and would also result in a net uptake of carbon because compost results in carbon storage in soils during application and therefore would not result in full decomposition. As a result, composting vegetation cleared from the site would result in net emissions of up to approximately -0.18 Mt CO_2e per wet ton of compost (EPA 2006b).

4.3.10.2 REDUCE ENGINE IDLING DURING CONSTRUCTION

An idling engine generally wastes fuel and contributes to air pollution. Although it is not known how much engine idling might occur during SSEP construction, reduction of engine idling or implementation of a "no idling" policy, where practicable, would conserve fuel, save money, and reduce construction-related GHG emissions.

4.3.10.3 USE BIODIESEL FUEL IN CONSTRUCTION EQUIPMENT

Biodiesel is a form of diesel fuel derived from biological sources instead of petroleum sources. The biological sources (such as vegetable oil) used to make biodiesel fuels sequester CO_2 as they grow. It is this sequestered CO_2 that is released upon fuel combustion that makes biodiesel a GHG-neutral fuel.

Typically, blends of biodiesel and petroleum fuels can be used in diesel engines without any need for engine modifications. When biodiesel is used, blends of 5% biodiesel and 95% petroleum diesel (B5) and 20% biodiesel and 80% petroleum diesel (B20) are common. The use of B5 biodiesel would reduce SSEP construction emissions from construction equipment and vehicles by 5%; the use of B20 biodiesel would reduce SSEP construction emissions from construction equipment and vehicles by 20%. The use of B5 or B20 biodiesel is encouraged wherever practicable.

4.3.10.4 USE BIODIESEL FUEL IN SSEP OPERATIONS EQUIPMENT AND VEHICLES

Biodiesel fuel could also be used, where practicable, in diesel-fueled SSEP operations vehicles. The same B5 and B20 biodiesel blends could be employed, and their use would result in respective GHG reductions in diesel fueled operations vehicles of 5% and 20%. Annual diesel equipment and vehicle GHG emissions at the 125-MW and 250-MW units under the Proposed Action are 113 Mt CO_2e and 73 Mt CO_2e per year, respectively (Farmer 2010, Appendix C).

4.3.10.5 INVESTIGATE PARTICIPATING IN THE EPA'S SF_6 EMISSION REDUCTION PARTNERSHIP FOR ELECTRIC POWER SYSTEMS

Boulevard would investigate joining EPA's SF_6 Emission Reduction Partnership for Electric Power Systems, and, at a minimum, consider

- annual inspection and estimation of SF_6 emissions using an emissions inventory protocol;
- for equipment that will contain SF_6, purchase only new equipment that meets International Council on Large Electric Systems (CIGRE) standards for leak rates;
- implement SF_6 recovery and recycling; and
- ensure that only knowledgeable personnel handle SF_6.

4.3.11 Residual Impacts

After implementation of the mitigation measures described above, the lifecycle GHG emissions of each alternative are shown in Table 4.42. Note that the measure "purchase carbon offsets" is not included due to its potential cost-prohibitive nature, and the measure "reduce engine idling during construction" is not included due to a lack of ability to quantify associated GHG emissions reductions. The brine concentrator option for the Proposed Action and Alternative B is not included because this option does not affect the climate change analysis (see Section 4.3.7).

Table 4.42 SSEP Residual Impacts – All Alternatives

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Lifetime Net GHG emissions before mitigation (Mt CO_2e)	0	-13,829,822	-12,537,620	-13,874,386	-9,058,160
Eliminate methane emissions from landfill	0	-8262	-8240	-4435	-2679
Use B20 fuel during SSEP construction (Mt CO_2e)	0	-1,832	-1,832	-604	-1,758
Use B20 fuel during SSEP 30-year operation (Mt CO_2e)	0	-1,117	-1,117	0	-872
Lifetime net GHG emissions after mitigation (Mt CO_2e)	0	-13,841,033	-12,548,809	-13,879,425	-9,063,469

Note: Individual values may not sum to the total due to rounding error.

After mitigation measures, all action alternatives would maintain a net lifetime GHG emissions level of less than zero and would therefore act to reduce GHG emissions levels.

4.3.12 Short-term Uses versus Long-term Productivity

The clearing of Project Area vegetation and construction activities associated with the SSEP would contribute to climate change through the short-term generation of GHG emissions. However, the long-term GHG emissions saved by the SSEP's renewable energy generation (versus grid electricity) would more than offset the short-term vegetation and construction-related GHG emissions, giving the SSEP a net negative lifetime GHG emissions level and making it a net mitigation of climate change in the long term. The implications of climate change for the region surrounding the SSEP are described below.

4.3.13 Irreversible and Irretrievable Commitments of Resources

The SSEP would result in irreversible emissions of GHGs during construction and operation activities. In addition, the SSEP would result in the irretrievable loss of carbon sequestration by Project Area vegetation until full site reclamation following termination of the project. However, the SSEP would also generate electricity with a lower GHG emissions intensity than the existing grid, which would offset its GHG emissions and result in an overall net decrease in GHG emissions relative to the No Action alternative.

4.4 Cultural Resources

4.4.1 Analysis Area and Analysis Assumptions

Impacts to cultural resources eligible for the NRHP must be considered under Section 106 of the NHPA. Federal agencies are required to identify any historic properties in the project APE and evaluate their eligibility status for the NRHP in consultation with the SHPO. If the resources are NRHP-eligible, agencies must assess whether or not the undertaking would have an adverse effect on those resources, and if necessary, avoid, minimize, or mitigate any adverse effects to those resources. Federal agencies must consult with the SHPO, the Advisory Council on Historic Preservation, and others (including Indian tribes and consulting parties) regarding adverse effect determinations and the resolution of adverse effects.

As discussed in Section 3.4, the cultural resources analysis area for the SSEP consists of 8,646 acres, which includes the approximately 3,620-acre footprint of the Proposed Action. In consultation with the SHPO, the BLM defined the APE as the cultural resource analysis area, which encompasses the entire 8,646 acres that received intensive archaeological survey. No agencies or tribes identified any specific locations of cultural or archaeological significance beyond the analysis area that could be affected by visual impacts of the proposed project.

Nine archaeological sites are present in the analysis area; of the nine sites, three prehistoric sites have been determined eligible for the NRHP, as follows:

- AZ T:10:238 (ASM) consists of an artifact scatter in a 105 × 20–m area (2,100 m^2). The scatter is dominated by plainware and buffware ceramics, but also includes a core tool or chopper.
- AZ T:14:165 (ASM) is an artifact scatter and two rock pile features in a 110 × 60–m (6,600 m^2) area. The artifacts include plainware and buffware ceramic sherds as well as lithic flakes, a hammer stone, and a ground stone fragment.
- AZ T:14:167 (ASM) consists of an artifact scatter and two rock concentrations in a 57 × 34–m (1,938 m^2) area. The artifacts include plainware, buffware, and red-on-buffware sherds and one piece of worked marine shell.

Existing information indicates that there were places and natural landmarks of traditional importance to the O'odham and Maricopa along the Gila River and in the Estrella Mountains. Archaeological evidence indicates that the Project Area was likely used as a travel corridor between villages along the river and hunting or gathering areas in nearby mountain ranges. The archaeological sites indicate temporary activities such as travel or camping.

In developing any plans to mitigate adverse effects through scientific data recovery, BLM will require that the data recovery plan include a discussion of the site's role within the context of prehistoric and tribal use of the surrounding landscape. Tribes have been consulted and offered the opportunity to comment and offer additional information relevant to this mitigation and to contribute to the analyses outlined in the data recovery plan.

The following analysis assumes that all ground-disturbing activities would be confined to the analysis area for each action alternative and that only the three sites identified above (AZ T:10:238 [ASM], T:14:165 [ASM], and T:14:167 [ASM]) within the analysis area are eligible for the NRHP. For the purposes of this analysis, an impact is considered adverse only if the site is eligible for the NRHP. Thus only impacts to these three sites are discussed.

An adverse impact exists when a project would alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (36 CFR § 800.5(A)(1). Adverse impacts are generally evaluated in regard to the qualities of integrity and the specific criteria that make a site eligible for the NRHP. Adverse impacts result from physical destruction, damage, or alteration of all or part of the site; or from alterations to the site's setting when the character of setting contributes to its eligibility. Additionally, there is no difference between temporary or permanent disturbance. All disturbances to the surface or subsurface deposits of archaeological sites are considered permanent. Disturbance of artifacts and features would affect a site's NRHP eligibility status, which is based on a site's potential to provide important information about the past. It is important to note that the implementation of mitigation measures would reduce adverse impacts to cultural resources.

4.4.2 No Action

Under the No Action alternative, Boulevard's ROW application for the SSEP under the Proposed Action, Alternative A, Sub-alternative A1, or Alternative B would not be approved. Livestock grazing and dispersed recreation in the Project Area would continue. Both of these activities would affect, in a limited manner, the three eligible historic properties. Livestock grazing would have a limited effect (loss of integrity) on site integrity because livestock grazing only occurs when infrequent rainfall allows for vegetation growth, and may not occur every year. Recreational use, such as hiking and hunting, would also have a minimal effect on site integrity due to the relatively limited use of the Project Area by these recreationists, the remoteness of the area, and the low visibility of the sites due to the fragmentary nature of the artifacts present. These factors, considered together, would deter discovery and most looting and vandalism. Motorized travel on designated routes would not affect any of the sites because the sites are off route and motorized recreationists would therefore not have access to them.

4.4.3 Proposed Action

Under the Proposed Action, approximately 3,620 acres would be disturbed by the construction of the SSEP facility; these 3,620 acres are considered the project footprint. Of the three NRHP-eligible archaeological sites, AZ T:10:238 (ASM) would be directly impacted by construction of the proposed facility and could not be avoided by project design. This site would be subjected to 100% ground disturbance resulting in the permanent elimination of the physical presence of the site. Therefore, the Proposed Action would result in short- and long-term direct adverse effects to AZ T:10:238 (ASM); however, through a program of data recovery, this adverse effect could be mitigated. Due to the permanent removal of the site, mitigation measures would be required prior to construction.

To address adverse effects, the BLM has consulted with the SHPO, Indian tribes, and other parties to develop an MOA to mitigate and resolve the adverse effects. The MOA addresses adverse effects through development of a treatment plan that includes provisions for scientific data recovery, monitoring, long-term protection, worker education, and treatment of unanticipated discoveries. The MOA defines the roles and responsibilities of the consulting parties. The Advisory Council on Historic Preservation was notified of the adverse effect determination in July 2011, but at this time, they have declined to participate as a signatory to the agreement. The MOA would be attached to the ROD for this project.

Intentional or unintentional disturbance of archaeological sites by SSEP workers and construction crews would be mitigated by requiring a program of worker education emphasizing site avoidance, reporting of unanticipated discoveries, and minimal disruption of permitted archaeological investigations. Workers would be informed that unauthorized collection of artifacts or disturbance of sites is illegal.

Sites AZ T:14:165 and 167 (ASM) are eligible for the NRHP and are situated in the analysis area (near the proposed transmission line and access road corridor); however, project design has been developed to avoid direct disturbance of these sites during construction and operation of the facility. Under the Proposed Action, the main access road would be paved, and a new transmission line would be installed along the road. The new transmission line would have an adverse visual effect on these sites by changing the view from and to the sites and therefore changing their setting; however, because the sites' NRHP eligibility is based on their potential to supply important information about the past, any effects to setting would not change their NRHP eligibility. Although road paving would make access to the sites easier and may increase the risk of looting and vandalism, the fragmentary nature of the artifacts would deter most looting and vandalism. In addition, the presence of the facility and associated workers would deter most looting by hikers, hunters, and other casual or recreational visitors. A program of long-term monitoring for these two sites would be necessary to ensure their continued avoidance during construction and operation of the facility and future maintenance of the transmission line and access road. Thus the MOA and treatment plan for the project would also include a monitoring and discovery plan that details the process of long-term monitoring at AZ T:14:165 and 167 (ASM), including reporting and treatment of discoveries during monitoring.

4.4.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, the project footprint would remain the same as under the Proposed Action. Because the project footprint under Alternative A would be the same as the Proposed Action, the impacts would be the same as the Proposed Action.

4.4.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, the project footprint would be approximately 44% smaller than that of the Proposed Action. However, due to the location of proposed facilities, direct adverse effects to AZ T:10:238 (ASM) and indirect effects to AZ T:14:165 and 167 (ASM) would be the same as those of the Proposed Action.

4.4.6 Alternative B: Reduced Footprint

Under Alternative B, the power plant footprint would be approximately 34% smaller than that of the Proposed Action. However, due to the location of proposed facilities, direct adverse effects to AZ T:10:238 (ASM) and indirect effects to AZ T:14:165 and 167 (ASM) would be the same as those of the Proposed Action

4.4.7 Reduced Water Use Option–Brine Concentrator

An optional brine concentrator in the power block area could be applied to either of the water-cooled action alternatives (the Proposed Action or Alternative B). There would be no changes to the project footprint of the Proposed Action or Alternative B under this option therefore the impact to cultural resources of including a brine concentrator under either alternative would be the same as described above.

4.4.8 Generation Tie Line Option

The Gen-tie Line Option could be added to any action alternative in place of the proposed gen-tie line alignment. If used, this option would be located within the existing cultural resources analysis area/APE, and impacts to cultural resources under this option would be the same as previously described (i.e., no effects to cultural resources from the gen-tie alignment and associated roads).

4.4.9 Potential Mitigation Measures

No potential mitigation measures outside of those described above are recommended. As described above, the BLM has consulted to develop an MOA that addresses adverse effects through development of a treatment plan that includes provisions for scientific data recovery, monitoring, long-term protection, worker education, and treatment of unanticipated discoveries. The treatment plan for the project would also include a monitoring and discovery plan detailing the process of long-term monitoring at AZ T:14:165 and 167 (ASM), including reporting and treatment of discoveries during monitoring. The MOA and treatment plan would be part of the ROD for this project.

4.4.10 Residual Impacts

There would be no potential mitigation measures for cultural resources; therefore impacts are the same as the direct and indirect impacts described under the alternatives.

4.4.11 Short-term Uses versus Long-term Productivity

The short-term use of the Project Area for renewable energy development would result in the physical removal of Site AZ T:10:238 (ASM) from the area. This would adversely affect the long-term productivity of cultural resources in the Project Area because this site and the scientific data associated with it would no longer be located in situ. Though this effect would be mitigated through data recovery, the removal of this site from the Project Area would mean that the site could no longer provide important information about the past.

4.4.12 Irreversible and Irretrievable Commitments of Resources

Because the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B would remove NRHP-eligible Site AZ T:10:238 (ASM), the disturbance to the site would represent an irreversible commitment of resources because the site would be permanently removed from the landscape. There would not be any irretrievable impacts on cultural resources as a result of the project.

4.5 Geology and Minerals

4.5.1 Analysis Area and Analysis Assumptions

The analysis area for geological and mineral resources consists of the Project Area. Areas of subsidence outside of the Project Area are addressed in the groundwater section of this EIS (see Section 4.18.2). Earthquakes or active faults have not been recorded in the Project Area (Kirby 2009a) therefore unlikely to impact or be impacted by the project. Further, the SSEP power plant would be designed in conformance with the 2006 International Building Code and with applicable wind and seismic criteria for the site location. For these reasons earthquakes, active faults, and landslides are not discussed further in this section.

Impacts to geology and minerals are discussed below in terms of 1) acres of disturbance within each geologic unit and 2) the availability of salable sand and gravel deposits. The availability of salable sand and gravel deposits assumes that noncompatible actions would not be authorized, and what would be precluded from development would be the well field, external linear facilities, and power plants (the main project footprint), as described for each alternative in Chapter 2.

4.5.2 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses in and adjacent to the Project Area would continue. These uses include livestock grazing and dispersed recreation in the Project Area, utility ROWs, and salable material production adjacent to the Project Area. Salable sand and gravel deposits in the area would remain available, though there are no current plans to develop these resources in the Project Area.

4.5.3 Proposed Action

4.5.3.1 LOCAL GEOLOGY

Under the Proposed Action, construction-related impacts to local geology would be from terrain modification (e.g., cuts, fills, drainage diversion channels, and protective berms) and dust generation (e.g., excavation and grading). These terrain modifications would result in a more consistent landform including a uniform slope across the Project Area and mixing of surface and subsurface materials. Dust generation and the potential for soil erosion associated with the SSEP are discussed further in Section 4.13 (Soils). Acres of disturbance within the two geologic units identified in the Project Area under the Proposed Action are detailed in Table 4.43.

Table 4.43 Acres of Disturbance within Geologic Units – All Action Alternatives

Long-term Disturbance	Proposed Action (acres)	Alternative A: Reduced Water Use (dry-cooled CST) (acres)	Sub-alternative A1: Photovoltaic (acres)	Alternative B: Reduced Footprint (acres)
Undivided Quaternary alluvium (Q)	3,587.0	3,578.3	1,982.1	2,361.7
Younger Quaternary alluvium (Qy)	1.7	1.7	1.6	1.6
Total long-term disturbance	*3,588.7*	*3,580.0*	*1,983.7*	*2,363.3*
Temporary Disturbance	**Proposed Action (acres)**	**Alternative A: Reduced Water Use (dry-cooled CST) (acres)**	**Sub-alternative A1: Photovoltaic (acres)**	**Alternative B: Reduced Footprint(acres)**
Undivided Quaternary alluvium (Q)	29.2	27.2	27.5	28.4
Younger Quaternary alluvium (Qy)	1.8	1.8	1.8	1.8
Total temporary disturbance	*31.0*	*29.0*	*29.3*	*30.2*
Total disturbance	**3,619.7**	**3,609.0**	**2,013.0**	**2,393.5**

4.5.3.2 MINERALS RESOURCES

Salable sand and gravel deposits are present in the Project Area. Construction and operation of the SSEP under the Proposed Action would preclude these deposits from being used in the approximately 3,620-acre Project Area for the life of the project (30 years). At the end of the useful life of the facility and termination of the ROW grant, salable deposits would again become available. However, during the life of the ROW grant these resources would remain within the Project Area.

The alluvium occurring within the Project Area tends to have surface deposits consisting of coarse material and subsurface deposits that are characterized by well-sorted silt, sand, and gravel to cobbles. The alluvium could become more uniform and less sorted as a result of surface-disturbing activities (cut, fill, drainage diversion, protective berms) necessary for project construction. This potential mixing could impact how future mineral extraction is performed (i.e., mixing of sand and gravel resources could require additional sorting). However, most surface-disturbing activities would come from site grading and would disturb an approximate average of 4 feet, with the maximum depth of 8 feet. Available materials under this maximum 8 foot depth would not be mixed.

4.5.4 Alternative A: Reduced Water Use (dry-cooled CST)

4.5.4.1 LOCAL GEOLOGY

Impacts to geology under Alternative A would be the same in nature as the impacts described under the Proposed Action. However, because of differences in the design and layout of the well field, slightly different acreages of the geologic units would be impacted. These acreages are shown in Table 4.43. Impacts to geologic units would be reduced by 8.7 acres (0.2%) for long-term disturbance and 2.0 acres (6.5%) for short-term disturbance when compared to the Proposed Action.

4.5.4.2 MINERALS RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits would be of the same nature under Alternative A and the Proposed Action. Under Alternative A, approximately 3,609 acres would be precluded from development for the life of the SSEP and could be mixed by project disturbance, which is a reduction of 10.7 acres (0.3%) when compared to the Proposed Action.

4.5.5 Sub-alternative A1: Photovoltaic

4.5.5.1 LOCAL GEOLOGY

Impacts to geology under Sub-alternative A1 would be the same in nature as the impacts described under the Proposed Action. However, because of the decrease in the project footprint under Sub-alternative A1, impacts to geologic units would be reduced by 1,605 acres (44.7%) for long-term disturbance and 1.7 acres (5.5%) for short-term disturbance when compared to the Proposed Action. These acreages are shown in Table 4.43.

4.5.5.2 MINERALS RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits under Sub-alternative A1 would be the same in nature as the impacts described under the Proposed Action. Under Sub-alternative A1, 2,013 acres would be precluded from development for the life of the SSEP and could have sand and gravel mixed by project disturbance, which is a reduction of 1,606.7 acres (44.4%) when compared to the Proposed Action.

4.5.6 Alternative B: Reduced Footprint

4.5.6.1 LOCAL GEOLOGY

Impacts to geology under Alternative B would be of the same nature as under the Proposed Action. However, due to the reduced footprint, smaller acreages of the geologic units would be impacted. These acreages are shown in Table 4.43. Impacts to geologic units would be reduced by approximately 1,225.4 (34.2%) acres for long-term disturbance and less than 1.0 acre (2.6%) for short-term disturbance, when compared to the Proposed Action.

4.5.6.2 MINERAL RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits would be of the same nature under Alternative B and the Proposed Action. Under Alternative B, approximately 2,394 acres would be precluded from development for the life of the SSEP and could be mixed by project disturbance, which is a reduction of approximately 1,226 acres (33.9%) when compared to the Proposed Action.

4.5.7 Reduced Water Use Option–Brine Concentrator

The brine concentrator could be added to either of the action alternatives that would use a wet-cooling system (the Proposed Action and Alternative B) and would not change the long-term or short-term acres of disturbance or the project boundary.

4.5.8 Generation Tie Line Option

4.5.8.1 LOCAL GEOLOGY

Impacts to geology under the Gen-tie Line Option would be similar in nature to the impacts described under the Proposed Action, except that only the Undivided Quaternary alluvium (Q) geologic unit would be disturbed by this gen-tie line alignment. As detailed in Table 4.44, impacts to Undivided Quaternary alluvium would increase by 8.3 acres if the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B. If the Gen-tie Line Option were added to Sub-alternative A1, impacts to Undivided Quaternary alluvium would be increased by 11.4 acres. Total surface disturbance in Undivided Quaternary alluvium would increase to no more than 0.56% depending on the alternative to which the Gen-tie Option is applied.

Table 4.44 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Geologic Resource	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Undivided Quaternary alluvium (Q)		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.5.8.2 MINERAL RESOURCES

An increase of 8.3 acres of disturbed land would occur if the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance when compared to the original gen-tie line alignment. Assuming that an increase in surface disturbance would be proportional to a decrease in the availability (and an increase in potential mixing) of salable sand and gravel deposits, the application of the Gen-tie Line Option would result in no more than 0.56% of additional impact to mineral resources.

4.5.9 Potential Mitigation Measures

No potential mitigation measures would be required beyond the applicant-committed environmental protection measures identified in Chapter 2 and the Proposed Action.

4.5.10 Residual Impacts

No potential mitigation measures would be required; therefore, impacts would be the same as discussed under the alternatives.

4.5.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would preclude salable sand and gravel resources from being used in the Project Area for the life of the project (30 years) and have the potential to mix surface layers with subsurface layers, but it would not impact the amount or availability of these resources after project decommissioning. Mixing of surface and subsurface layers would not remove the mineral resource, only potentially change the way the sand and gravel could be extracted. Therefore, long-term impacts to the productivity of mineral resources would be minor.

4.5.12 Irreversible and Irretrievable Commitments of Resources

Salable sand and gravel resources in the Project Area would be unavailable for the life of the project (30 years), resulting in an irretrievable impact to the availability and production of mineral materials within the Project Area. The sand and gravel could become more uniform and less sorted as a result of surface-disturbing activities (cut, fill, drainage diversion, protective berms). This potential mixing could impact how future mineral extraction is performed (i.e., mixing of sand and gravel resources could require additional sorting). However, there would be no irreversible impact because construction and operation of the SSEP would not preclude these resources from being used after decommissioning of the SSEP, nor would they change the deposits in a way that would change the potential for extraction.

Irreversible impacts would occur from terrain modifications that would result in a more consistent landform. This change would include a more uniform slope across the Project Area and mixing of surface and subsurface materials. During reclamation, all practical means would be made to restore the land to its original natural patterns; however, the mixing of surface and subsurface materials could not be reversed.

4.6 Hazardous Materials and Hazardous and Solid Waste

4.6.1 Analysis Area and Analysis Assumptions

The area of analysis for hazardous materials and hazardous and solid waste consists of the Project Area (where these materials would be generated and used) and proposed transportation routes to existing disposal sites in Maricopa County.

Because the primary impact from hazardous materials and hazardous and solid waste would be from potential leaks and spills and potential contamination of surrounding soils, surface waters, and groundwater, these materials are discussed in terms of 1) the type and amount of material that would occur on-site for construction and operation of the SSEP, 2) their relative risk, and 3) how these materials and wastes would be managed for the SSEP to prevent these impacts. Certain chemicals and materials that would be used during the construction and operation of the SSEP are characterized as hazardous materials. Improperly handled chemicals and other hazardous materials have the potential to cause health issues in humans. SSEP construction and operation activities would generate certain hazardous and nonhazardous solid waste streams. Hazardous materials, wastes, and regulated, nonhazardous solid wastes are governed by the LORS discussed in Chapter 3, Section 3.6.2.1 and 3.6.2.2. Additional discussion of each of the LORS identified in Chapter 3 can be found in the *Hazardous Materials and Wastes Technical Report* (Parke 2009). A full SPP would be developed and implemented prior to construction of the SSEP. With adherence to these LORS as well as the applicant-committed environmental protection measures described in Chapter 2, Section 2.3.2, and implementation of the SPP, there would be no impacts to surrounding soils, surface water, or groundwater.

A variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials (e.g., hazardous material business plan). Plant personnel would be supplied with appropriate PPE and would be properly trained in the use of PPE, the handling, use, and clean-up of hazardous materials used at the facility, as well as procedures to be followed in the event of a leak or spill. Adequate supplies of appropriate clean-up materials would be stored on-site.

4.6.2 No Action

Current activities in the area, livestock grazing and dispersed recreation use, would not result in the generation, use, or disposal of hazardous materials and hazardous and solid waste within the Project Area.

4.6.3 Impacts Common to all Action Alternatives

All action alternatives would involve the use and generation of hazardous materials and hazardous and solid waste during construction and operation of the SSEP. A list of identified hazardous materials and relative toxicity and hazard class is provided in Table 4.45. In general, the types, quantities of materials, and management of these materials would not change under each alternative. If any quantities or types would change under the alternatives, they are discussed in the action alternatives' respective sections.

The primary direct impacts from hazardous materials and hazardous and solid waste would come from the potential for contamination of soils from spills and leaks during construction and operation of the SSEP. Potential impacts from hazardous materials, wastes, and regulated, nonhazardous solid wastes would be mitigated by adherence to the LORS listed in Chapter 3, Section 3.6.2.1; site-specific plans listed in each of the following detailed sections; as well as the applicant-committed environmental protection measures listed in Chapter 2, Section 2.3.2.

Table 4.45 Chemical Inventory and Estimated Usage Rates

Hazardous Material	Relative Toxicity[1] and Hazard Class
Natural gas (methane)	Low toxicity; Hazard class – Flammable gas
Hydrogen	Low toxicity; Hazard class – Flammable gas
Sodium hydroxide, 50% solution	High toxicity; Hazard class – Corrosive
Sodium hypochlorite, 12.5% solution	High toxicity; Hazard class – Poison-B, Corrosive
Sulfuric acid, 29.5% solution	High toxicity; Hazard class – Corrosive, water reactive
Sulfuric acid, 93% solution	High toxicity; Hazard class – Corrosive, water reactive
CO[2]	Low toxicity; Hazard class – Nonflammable gas
Therminol VP-1 Diphenyl ether (73.5%) Biphenyl (26.5%)	Moderate toxicity; Hazard class – Irritant; Combustible Liquid (Class III-B)
Lube Oil	Low toxicity; Hazard class – n/a
Mineral insulating oil	Low toxicity; Hazard class – n/a
Diesel fuel	Low toxicity; Hazard class – Combustible liquid
Nitrogen (liquid)	Low toxicity; Hazard class – Non flammable gas
Hydraulic fluid	Low to moderate toxicity; Hazard class – Class IIIB combustible liquid
Water treatment chemical NALCO Tri-Act 1800 Cyclohexlyamine (5%–10%) Monoehtanolamine (10%–30%) Methoxyproplyamine (10%–30%)	High toxicity; Hazard class – Corrosive, Class II Combustible liquid
Water treatment chemical NALCO Elimin-Ox Carbohydazide (5%–10%)	Moderate toxicity; Hazard class – Sensitizer
Water treatment chemical NALCO 3D Trasar 3DT185 Phosphoric Acid (60%–100%)	High toxicity; Hazard class – Corrosive
Water treatment chemical NALCO 3D Trasar 3DT177 Phosphoric acid (30%)	Moderate toxicity; Hazard class – Irritant
Water treatment chemical NALCO 3D Trasar 3DT190	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO Acti-Brom (R) 7342 Sodium bromide	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO pHreedom® 5200M Sodium salt of phosphonomethylated diamine	Low to moderate toxicity; Hazard class – Irritant

Table 4.45 Chemical Inventory and Estimated Usage Rates

Hazardous Material	Relative Toxicity[1] and Hazard Class
Water treatment chemical NALCO PCL-1346	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO Permacare (R) PC-7408 Sodium bisulfite	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO BT-3000 Sodium hydroxide Sodium tripolyphosphate	High toxicity; Hazard class – Corrosive
Water treatment chemical NALCO 8338 Sodium nitrite Sodium tolytriazole Sodium hydroxide	Moderate toxicity; Hazard class – Toxic
Welding gas Acetylene	Moderate toxicity; Hazard class – Toxic
Welding gas Oxygen	Low toxicity; Hazard class – Oxidizer
Welding gas Argon	Low toxicity; Hazard class – Nonflammable gas
Fertilizer Urea	Low toxicity; Hazard class – n/a
Fertilizer Monopotassium phosphate	Low toxicity; Hazard class – Irritant
Activated Carbon	Nontoxic (when unsaturated), low to moderate toxicity when saturated, depending on the adsorbed material; Hazard class – combustible solid
Herbicide Roundup® or equivalent	Low toxicity; Hazard class – Irritant
Soil stabilizer Active ingredient: acrylic or vinyl acetate polymer or equivalent	Nontoxic; Hazard class – n/a

[1] Low toxicity is used to describe materials with a National Fire Protection Association (NFPA) health rating of 0 or 1. Moderate toxicity is used describe materials with an NFPA rating of 2. High toxicity is used to describe materials with an NFPA rating of 3. Extreme toxicity is used to describe materials with an NFPA rating of 4.

[2] n/a denotes materials that do not meet the criteria for any hazard class defined in the 1997 Uniform Fire Code.

4.6.3.1 COMPRESSED GAS STORAGE

All action alternatives would result in other compressed gases stored and used at the SSEP. These gases would consist of acetylene, argon, and oxygen, which are typical for maintenance activities such as shop welding. Acetylene is a flammable gas and a narcotic. It is highly reactive and is not toxic. Oxygen is an oxidizer with low toxicity. Argon has low toxicity but may cause asphyxiation if released in a confined area. It is anticipated that the SSEP would have 800 cubic feet of each of these gases stored on-site at any given time. The potential for any of these materials to cause a fire at the SSEP would be managed by the following site-specific plans:

- Compressed gases would be stored in standard compressed gas cylinders at the facility (typically 200 cubic feet per cylinder), and the total quantity would be kept to the minimum required for operation and maintenance.

- The compressed gases would be delivered and stored in U.S. Department of Transportation (USDOT)-approved safety cylinders, and secured to a solid support (such as a building or rack) to prevent tipping and physical damage.
- The compressed gases would be stored in an isolated storage area surrounded by crash posts to minimize potential for accidents or upset.
- Incompatible gases (e.g., flammable gases and oxidizers) would be stored in separate, isolated areas.
- Operators would be trained in the proper use of equipment and materials.

4.6.3.2 PETROLEUM PRODUCTS

All action alternatives would result in the storage and use of lube oil, diesel fuel, and insulating oils at the SSEP. Lube oil has low toxicity and does not meet the criteria for any hazard class defined by the Uniform Fire Code (UFC). Diesel is a combustible liquid with low toxicity. Insulating oil has low toxicity and is not classified as a hazardous material. Surface water and/or groundwater quality could be impacted by an accidental release of one or more of these materials from a vehicle or motorized piece of equipment. The amounts of these materials anticipated to be on-site are detailed in Table 4.46.

Table 4.46 Petroleum Products Used at the SSEP

Petroleum Product	Estimated Quantity
Lube oil	10,000 gallons in equipment and piping, additional maintenance inventory of up to 550 gallons in 55-gallon steel drums.
Mineral insulating oil	32,000 gallons
Diesel fuel	300 gallons

The potential impacts presented by the use of these petroleum products at the SSEP would be managed by the following site-specific plans:

- Lube oil would be stored in a 10,000-gallon carbon steel tank associated with the steam turbine. The turbine enclosure would provide secondary containment sufficient to hold the full contents of the tank.
- The carbon steel tank would be inspected daily to ensure that it is not leaking.
- Diesel fuel would be stored in the fire water pump engine in a carbon steel tank. The fire water pump would be contained within the equipment skid to provide secondary containment.
- Insulating oil would be used in the electrical transformers. Each of these transformers would be installed in a secondary containment structure that would contain 100% of the transformer capacity plus an allowance for precipitation.
- An SPP would be prepared to describe the storage of oil, the spill prevention measures employed by the facility, the potential consequences of a spill, and spill response measures developed by the facility to respond to an oil spill. The SPP would also describe the inspection and monitoring performed by the facility associated with oil storage.

4.6.3.3 USED HYDRAULIC FLUIDS, OILS, GREASES

All action alternatives would generate hazardous waste streams (i.e., spent hydraulic fluids and oils, oily rags, greases, and oily effluent from the water treatment separator system during operation of the SSEP), which would have the potential to contaminate surrounding soils, surface, and groundwater. In addition, several uses of lubricant oils in the operation and maintenance of the SSEP facility and equipment would generate used oil that would not be deemed a hazardous waste.

Under all action alternatives, the SSEP would be expected to generate 70,000 gallons per year or less of spent hydraulic fluids and oils, 5,000 gallons per year or less of oily effluent from the water treatment separator system, and six 55-gallon drums or less per month of oily rags and filters. The potential impacts from used hydraulic fluids, oils, and greases would be managed by the following site-specific plans:

- These materials would be accumulated and maintained on-site for less than 90 days in a secure hazardous waste accumulation area within secondary containment.
- These materials would be shipped off-site within 90 days of entering the accumulation area under manifest, via a licensed hazardous waste transporter.
- These wastes would be recycled to the extent practicable. For example, oils, hydraulic fluids and oil/water separator effluent may be recovered and recycled.
- Oily rags and oil adsorbent material (to capture spills) would be generated as a normal aspect of plant maintenance. These materials would be shipped off-site for energy recovery or disposal in a licensed waste management facility.
- Nonhazardous used oils would be captured in leak-free containers, accumulated in properly labeled containers in a designated accumulation area, and periodically shipped off-site for energy recovery or disposal in a licensed waste management facility.

4.6.3.4 HAZARDOUS SOLVENTS/CLEANING SOLUTIONS

Waste cleaning solutions and solvents, some of which may be classified as hazardous, would be generated during normal equipment maintenance and repair and would have the potential to contaminate surrounding soils, groundwater, and surface water. Less than 500 gallons per year would be generated by the SSEP. The potential impacts from used solvents and cleaning solutions would be managed by the following site-specific plans:

- These waste solutions would be accumulated in suitable, labeled containers within a secure hazardous waste accumulation area within secondary containment. These materials would be shipped off-site for energy recovery or recycled at a licensed waste management facility.

4.6.3.5 SOIL STABILIZER

All action alternatives would require a periodic application of a polymer dust suppressant/soil stabilizer to reduce fugitive dust emissions in the solar field. Potential dust coatings include magnesium chloride (MgCl) and commercially available polymers. These soil stabilizers consist of water emulsions of acrylic or vinyl acetate polymers. These products are nontoxic and do not meet the definition of any hazard classification. These soil stabilizers would not be stored on-site at the SSEP, but supplied in 55-gallon drums or 400-gallon totes to be used immediately.

4.6.3.6 UNIVERSAL WASTES

Under all action alternatives, spent batteries, fluorescent bulbs, and excess/unused pesticides would be expected to be present at the SSEP. Less than 75 of these items per month would be generated at the facility. Spent batteries from trucks and automobiles would be generated intermittently with less than 20 per two years. The potential impacts from universal wastes would come from contamination of surrounding soils, surface water, or groundwater. These impacts would be managed by the following site-specific plans:

- The SSEP facility would comply with universal waste rules by properly labeling, handling, and storing universal wastes. Materials would be accumulated for less than one year (less than 90 days for spent batteries).
- After collection in labeled accumulation containers, the SSEP facility would ensure that the transport of these wastes off-site for recycling or disposal is performed by licensed universal waste disposal companies.
- The facility would maintain the required records related to generation and disposal of universal wastes.
- SSEP employees would receive training regarding the collection and disposal of universal waste materials, and they would implement applicable regulatory requirements.

4.6.3.7 CONSTRUCTION WASTES

During construction of the SSEP, several wastes streams would be generated that would require management and appropriate disposal to prevent contamination to soils, surface water, and groundwater. These materials and the anticipated quantities are listed Table 4.47. The potential impacts from these construction wastes would be mitigated by the on-site handling and management method and disposal (Table 4.47).

Table 4.47 Construction Waste Streams

Waste Stream and Classification	Origin/ Composition	Estimated Quantity	Frequency of Generation	On-site Handling	Management Method and Disposal
Construction wastes–hazardous	Empty or partially empty containers of hazardous materials	<2 cubic yard per week of construction	Intermittent	Accumulate in designated area for less than 90 days	Return containers to vendor or transport under manifest to permitted treatment/disposal facility
Construction wastes–hazardous	Solvents, waste oils, paints, oily rags	< 200 gallons per 90 days	Intermittent	Accumulate in designated area for less than 90 days	Return containers to vendor or transport under manifest to permitted treatment/disposal facility
Heat exchanger/boiler cleaning waste fluid– hazardous[1]	Chelant type solutions, dissolved metals	< 1,000 gallons	One-time event during commissioning of 125-MW and 250-MW plants	Capture in suitable tanks and containers	Transport under manifest to permitted hazardous waste treatment/disposal facility
Spent Batteries, excess pesticides and containers–universal waste	Lead acid batteries, alkaline batteries, pesticides	20 batteries during construction; < 50 gallons of waste pesticides	Intermittent	Accumulate in designated labeled containers for less than 180 days	Recycle to extent practical, otherwise transport to local landfill qualified to receive universal wastes

Table 4.47 Construction Waste Streams

Waste Stream and Classification	Origin/ Composition	Estimated Quantity	Frequency of Generation	On-site Handling	Management Method and Disposal
Construction waste–nonhazardous	Scrap wood, concrete, steel, glass, plastic, paper	<40 cubic yards per week	Intermittent	Accumulate in suitable on-site containers	Recycle to extent practicable, otherwise dispose to local municipal waste landfill
Office and other conventional facility wastes	Paper, aluminum, plastics, waste food	< 200 gallons per day	Intermittent	Accumulate in suitable on-site containers	Recycle to extent practicable, otherwise dispose to local municipal waste landfill

[1] Would not be produced as part of Sub-alternative A1.

4.6.3.8 DISPOSAL OF WASTES AND TRANSPORTATION ROUTES

4.6.3.8.1 Waste Disposal Sites

Under all action alternatives, wastes generated during the construction and operation of the SSEP would be managed in a manner that suits the type and category of waste. Many nonhazardous waste streams can be recycled. Hazardous wastes generated during the construction and operation of the SSEP would be accumulated and contained on-site, in accordance with applicable LORS discussed in Chapter 2, Section 3.6.2 and as discussed in this section. Under suitable manifest, such materials would be taken off-site by a licensed shipper to a permitted treatment, storage, and disposal facility. Qualified waste disposal sites in Maricopa County are listed in Chapter 3, Section 3.6.4. Sufficient capacity is present at these facilities so that the additional waste materials generated by the SSEP would be accommodated (Parke 2009)

4.6.3.8.2 Transportation of Wastes

The Hazardous Materials Transportation Act (HMTA) regulates the transportation of hazardous materials and is implemented by the USDOT under 49 CFR §§ 171–179. The EPA has similar requirements in place for hazardous wastes (40 CFR § 263). The HMTA requires chemical manufacturers and hazardous waste generators and transporters to follow certain preparation, packaging, handling, loading/off-loading, routing, emergency planning, notification, and insurance requirements.

The HMTA requirements supplement the Resource Conservation and Recovery Act requirements regarding hazardous wastes. To comply with these requirements, SSEP employees who would be involved in the shipping or receiving of chemicals, or shipping parts, products, or subassemblies that could be contaminated with hazardous substances, wastes (or residue) would follow the specified procedures for packaging, labeling, and shipping of these regulated materials. Further, SSEP employees involved in these activities would receive training in the required procedures.

Transportation of wastes and contaminated containers from the SSEP site would be contracted to a qualified waste transporter, and the wastes would be taken, under manifest, to a permitted local landfill or treatment and disposal facility. Transportation of wastes from the SSEP site would use roadway routes that are suitable for hazardous waste transport. The roads and disposal sites in relation to the Project Area can be found on Map 12. These roads are established routes for commercial highway trucks. They offer no particular hazard for accidental release because they adhere to the LORS for hazardous material transportation (see Chapter 3, Section 3.6.2).

4.6.3.9 ELECTRICAL MAGNETIC FIELDS

Under all action alternatives, generation of EMFs through electrical generation, transmission, or distribution could result in human health and safety-related impacts. Average residential exposure to magnetic fields ranges from 0.055 to 0.110 microtesla (μT) in the United States; although, magnetic fields can approach 20 μT near power lines (World Health Organization [WHO] 2007). Studies of the potential effects of EMF exposure on animal behavior, physiology, endocrine systems, reproduction, and immune functions have typically examined exposures much higher and longer than would be encountered by wildlife or humans under actual field conditions. WHO (2007) reports that "power-frequency fields of much less than the geomagnetic field of around 50 μT are unlikely to be of much biological significance." Several large-scale, long-term studies in rodents do not show any consistent increase in any type of cancer, including haematopoietic, mammary, brain, and skin tumors. There is no evidence that EMF exposure alone causes cancer in animals. In addition, the evidence that EMF exposure in combination with known carcinogens can enhance cancer development cannot be interpreted as supporting or opposing the relationship between EMF and cancer, due to major research design or analysis limitations and limited data (WHO 2007).

4.6.4 Proposed Action

4.6.4.1 ACTIVATED AND SPENT CARBON

Under the Proposed Action, the HTF expansion tank(s) would be vented through a two-stage, activated carbon system for the control of air emissions from the tank(s). Each stage of the system would comprise a 2,000-pound capacity carbon canister for a total of 4,000 pounds of inventory. However, the facility would not maintain an inventory of additional carbon. New activated carbon has low toxicity, but once it is in use, it can absorb VOCs and HAPs, including benzene, phenol, and biphenyl. This absorption can cause the toxicity to increase. Activated carbon is difficult to ignite, but smolders once ignited. When nearly saturated, the spent carbon must be removed from service and the canisters must be replaced. Activated carbon containing above-threshold amounts of toxic organic compounds is classified as a hazardous waste. Based on projected emissions levels, it is estimated that up to 400,000 pounds per year of spent carbon may be generated. The potential for fire or increased toxicity would be managed by the following site-specific plans:

- The emissions control system would be monitored periodically (with a frequency specified in the air operating permit) to determine the saturation level of the carbon.
- Spent carbon would be contained in the canister units, and it would be shipped off-site via a licensed waste transporter to a licensed management facility for regeneration.

4.6.4.2 HYDROGEN

Under the Proposed Action, a maximum of 63,000 standard cubic feet (335 pounds) of hydrogen would be stored on-site at any one time within the equipment cooling loop and "tube trailer." The potential for risk of fire or explosion would be managed by the following site-specific plans:

- The hydrogen tanks on the tube trailer would be to USDOT specifications and capable of withstanding the normal abuse of highway travel.
- The tube trailer would be located outside, remote from the steam turbine generator, and away from electrical lines and other potential ignition sources, as required by applicable building and fire codes.
- Standard industry practices would be employed to safeguard the hydrogen tanks, including leak detection systems, pressure/temperature monitoring, automatic generator shutdown, fire detection/suppression systems, placement of tanks in areas away from most vehicular traffic, and the installation of crash posts to protect the tanks from vehicular impact.

4.6.4.3 WASTE MIRROR GLASS

Under the Proposed Action, exposure to wind and other elements could cause cracks and breakage of parabolic concentrator mirror glass. During maintenance events, a section of broken mirror would be replaced. It is not possible to quantify the broken mirror glass that would need to be replaced. Broken glass would be handled in the method described below:

- Broken mirror glass would be recycled.
- If a recycling facility is not available to take the broken mirrors, waste mirror glass may be classified as a hazardous waste, due to the Pb content of the glass. Glass wastes would be accumulated in suitable containers on-site for up to 90 days. The glass would be shipped off-site under manifest for treatment and/or disposal in a permitted landfill.

4.6.4.4 HERBICIDES

Under the Proposed Action, SSEP would contract the weed control program to an outside contractor to minimize fire potential. Based on historical use at Boulevard's Solar Energy Generating Systems (SEGS) facilities in California, annual usage of herbicide is approximately 10 pounds per acre. For the SSEP, this corresponds to approximately 37,000 pounds annually for the Proposed Action.

BLM-approved herbicides would be used in the solar field to control vegetation. At Boulevard's SEGS facilities, herbicides typically used for this purpose include Griffin Direx 80DF, Dupont Karmex DF, and Dupont Oust. The SSEP would employ similar herbicides. Impacts from herbicide would be the potential for runoff into surface water and seepage into groundwater (see Section 4.18). This potential impact would be managed by the following site-specific plans:

- Herbicide would not be stored on-site.
- The contractor would be required to hold the appropriate licenses and have a robust safety program for its employees. Industry-standard safety practices would be followed while using herbicides, including a) the use of personal protective equipment (for both contractor and SSEP employees) such as long-sleeved shirts and pants, coveralls, and chemically resistant gloves; b) thorough hand washing with soap and water after herbicide handling and before eating or drinking; c) the removal and proper disposal of any clothing or absorbent materials that have been contaminated with herbicide; and d) the use of herbicides only where there is adequate ventilation.

4.6.4.5 HEAT TRANSFER FLUID

Under the Proposed Action, approximately 1,500,000 gallons of HTF would be in process within the solar fields and power blocks; however, no reserve HTF would be stored on-site. The heat transfer system is a closed loop, and the system pressure would be monitored continuously. During operation of the SSEP, leaks of HTF could occur and have the potential to contaminate surrounding soils. The potential for HTF leaks and any impacts from those leaks would be managed by the following site-specific plans:

- The solar field would be regularly monitored by the operations staff using sight, sound, and smell to detect system leaks.
- Isolation valves would be installed throughout the solar field to minimize the HTF fluid loss in the event of a system leak.
- The isolation valves would be designed for automated operation triggered by a pressure drop in the system, or manual operation if a leak is detected by other means.

- In order to identify and react to larger leaks quickly, the SSEP would incorporate pressure sensing equipment and automatic controls that would allow for isolation of large areas of the field.
- Leaks would be repaired immediately.
- In the event of a leak, soils would be excavated, sampled, and analyzed for total petroleum hydrocarbon content (TPH).
- Soils found to have TPH concentrations in excess of 5,000 mg/kg, (considered hazardous petroleum contaminated soil [PCS] under ADEQ) would be disposed of off-site utilizing the services of a licensed special waste shipper as detailed in Chapter 2, Section 2.5.4.2.3.
- Soils found to have TPH concentrations less than 5,000 mg/kg would be spread in the land treatment area and treated as detailed in Chapter 2, Section 2.5.4.2.3.

Based on available operation data from other sites, it is anticipated that approximately 30 cubic yards (on average) of HTF-affected soil with greater than 5,000 mg/kg HTF may be generated per year and managed as hazardous waste, as described above. The generation of approximately 2,250 cubic yards of HTF-affected soil with less than 5,000 mg/kg HTF is anticipated (personal communication, Brandon Stankiewicz 2010). Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

4.6.4.6 NATURAL GAS AND GAS DELIVERY

The Proposed Action would result in approximately 140 pounds of natural gas present on-site in the pipelines and equipment. There would be no on-site storage of natural gas. Natural gas consists mainly of methane (approximately 95%). Methane is a flammable gas with a NFPA hazard rating of four with low toxicity. The maximum, annual natural gas usage for the SSEP would be 3,900 million standard cubic feet per year for a maximum of 3,982,000 MMBtu/year. The potential risk of a natural gas pipeline rupture would be managed through the following site-specific plans:

- After construction, the gas pipeline would undergo hydrostatic testing that involves filling the line with water, venting all air, increasing the pressure to the specified code requirements, and holding the pressure for a period of time to ensure the integrity of the pipe.
- The design of the pipeline would adhere to USDOT specifications.
- On-site facilities (gas metering) would be designed and operated to industry standards.
- Applicable codes would be adhered to and the appropriate operational procedures standard in the industry would be developed and implemented.

4.6.4.7 WATER TREATMENT

The Proposed Action would result in the storage of large quantities of sulfuric acid, sodium hydroxide, and sodium hypochlorite. These chemicals would be used for water treatment. Sulfuric acid is corrosive (capable of eating away by chemical action) and water reactive (undergoes a chemical reaction with water). Sulfuric acid is typically hazardous only by direct physical contact (where it can cause severe burns). Sodium hydroxide is corrosive (has the power to corrode) though it is typically hazardous only by direct physical contact. Sodium hypochlorite is poisonous and corrosive.

Table 4.48 details the water treatment chemicals and the quantities that would be on hand under each action alternative.

Table 4.48 Water Treatment Chemicals and Estimated Usage Rates – All Action Alternatives

Water Treatment Chemical	Proposed Action Estimated Usage Rate	Alternative A: Reduced Water Use Estimated Usage Rate	Sub-alternative A1: Photovoltaic Estimated Usage Rate	Alternative B: Reduced Footprint Estimated Usage Rate
Sodium hydroxide, 50% solution	8,500 gallons	8,500 gallons Remains the same as under the Proposed Action	None	8,500 gallons Remains the same as under the Proposed Action
Sodium hypochlorite, 12.5% solution	17,000 gallons	Would reduce to 8,500 gallons	None	17,000 gallons Remains the same as under the Proposed Action
Sulfuric acid, 93% solution	16,000 gallons	Would reduce to 8,000 gallons	None	16,000 gallons Remains the same as under the Proposed Action

In addition to the above chemicals, corrosion inhibitors, oxygen scavengers, pH buffers, and anti-scaling agents would be required on-site under all action alternatives. Eleven water treatment products would be used in the boiler feedwater and cooling tower applications. Approximately 800 gallons of all these treatment products would be on-site.

The potential impacts to surrounding soils, surface water, and groundwater presented by the use of these chemicals at the SSEP would be managed by the following site-specific plans:

- Each of the chemicals would be stored in tanks constructed of a chemically compatible material to minimize the potential for catastrophic failure of the tank.
- A spill containment structure surrounding each storage tank would be provided to contain spills and leaks. Concrete spill containment structures would be coated with a corrosion-resistant material such as epoxy.
- The water treatment products would be stored in the same 400-gallon (nominal) plastic totes that they are shipped in. Shipping and storing the products in the same container minimizes chemical transfers, and thus minimizes the chances of a spill. The totes would be provided with secondary containment sufficient to hold the full stored contents with an allowance for precipitation.
- Solid wastes that would be generated in the form of spent demineralizer and softener resins, wastewater treatment plant filter cake and dewatering sludge, and cooling tower basin sludge would be characterized on a periodic basis, in accordance with applicable laws and regulations. These wastes would be sent off-site for disposal to a waste management facility.
- Water treatment-related wastes would be accumulated in appropriate containers or process vessels at the SSEP facility. Materials would be picked up by a qualified waste shipper and disposed of at a waste management facility.

4.6.5 Alternative A: Reduced Water Use (dry-cooled CST)

4.6.5.1 ACTIVATED AND SPENT CARBON

Under Alternative A, activated and spent carbon volumes would remain the same as outlined in the Proposed Action.

4.6.5.2 HYDROGEN

Under Alternative A, hydrogen volumes would remain the same as outlined in the Proposed Action.

4.6.5.3 WASTE MIRROR GLASS

Under Alternative A, waste mirror glass and replacement methods would remain the same as outlined in the Proposed Action.

4.6.5.4 HERBICIDES

Under Alternative A, herbicide use would remain the same as outlined in the Proposed Action.

4.6.5.5 HEAT TRANSFER FLUID

Under Alternative A, HTF volumes would remain the same as outlined in the Proposed Action.

4.6.5.6 NATURAL GAS AND GAS DELIVERY

Under Alternative A, less efficient dry cooling would allow less energy production from the (same sized) solar field than under the wet-cooled Proposed Action. Total solar generation would be approximately 9% less than the anticipated generation under the Proposed Action. The allowable gas-fired generation (no more than 25%) would drop proportionally (about 9%) to an approximate maximum of 3,623,620 MMBtu/year, or 3,549 million standard cubic feet per year. Site-specific plans would remain the same as under the Proposed Action.

4.6.5.7 WATER TREATMENT

Under Alternative A, there would be a 50% reduction in the amount of hypochlorite and sulfuric acid used at the SSEP. All other water treatment chemicals usage rates would remain the same. Site-specific plans would remain the same as under the Proposed Action. Table 4.48 details other changes from the Proposed Action.

Although there would be a reduction in the use of water treatment products under Alternative A, there would be no change to the amount stored at the SSEP due to minimum tank volumes that would be held on-site because of storage trunk sizes.

4.6.6 Sub-alternative A1: Photovoltaic

4.6.6.1 ACTIVATED AND SPENT CARBON

Under Sub-alternative A1, no activated and spent carbon volumes would be required.

4.6.6.2 HYDROGEN

Under Sub-alternative A1, no hydrogen volumes would be required.

4.6.6.3 WASTE MIRROR GLASS

Under Sub-alternative A1, no waste mirror glass would be generated.

4.6.6.4 HERBICIDES

Under Sub-alternative A1, herbicide use would be approximately 45% (20,350 pounds) less than the Proposed Action. Most solar field vegetation would be allowed to grow up to 18–24 inches in height and would be controlled with periodic mowing. Herbicides would primarily be used to control noxious weeds in disturbed areas and on unimproved roads in the solar field.

4.6.6.5 HEAT TRANSFER FLUID

Under Sub-alternative A1, no HTF volumes would be required.

4.6.6.6 NATURAL GAS AND GAS DELIVERY

Under Sub-alternative A1, no natural gas pipeline would be required.

4.6.6.7 WATER TREATMENT

Under Sub-alternative A1, no sodium hydroxide, hypochlorite, or sulfuric acid would be required. Daily water treatment chemicals would include one 55-gallon tote of bisulfite and one 15-gallon tote of anti-scalant.

4.6.6.8 HAZARDOUS MATERIALS ASSOCIATED WITH PV PANELS

PV cells convert sunlight into electricity through the use of thin layers of materials known as semiconductors. Semiconductors can be constructed of single crystals, semicrystals, polycrystals, or amorphous materials and thin films. The exact type of PV solar panel that would be used at the SSEP has not been determined, but is likely to be a crystalline silicon panel or thin film panel. Crystalline silicon cells have been the most commonly used PV cells and are expected to continue as the dominant type through approximately 2008–2013 (Public Interest Energy Research Program and Electric Power Research Institute 2003). Silicon semiconductor material is considered nonhazardous (BLM and DOE 2010).

Materials used in thin-film solar cells include amorphous silicon, polycrystalline silicon, and compound semiconductors such as cadmium telluride, cadmium sulfide, copper sulfide, copper indium deselenide, copper indium gallium diselenide, copper gallium diselenide, germanium, and gallium arsenide (Public Interest Energy Research Program and Electric Power Research Institute 2003). Cadmium is the primary metal of concern and has a high toxicity (BLM and DOE 2010).

The potential for chemical releases from PV panels is small because chemicals are present within the sealed PV modules (Public Interest Energy Research Program and Electric Power Research Institute 2003). Leaching from cracked or broken modules could occur while panels are in service, during decommissioning, or after disposal. Researchers have concluded that releases due to leaching would result in a negligible potential for human exposures (BLM and DOE 2010). At the SSEP, panels broken during installation and operations, as well as panels removed during decommissioning, would be sent to an approved recycling facility for disposal.

4.6.7 *Alternative B: Reduced Footprint*

4.6.7.1 ACTIVATED AND SPENT CARBON

Under Alternative B, activated and spent carbon volumes would remain the same as under the Proposed Action.

4.6.7.2 HYDROGEN

Under Alternative B, hydrogen volumes would remain the same as under the Proposed Action.

4.6.7.3 WASTE MIRROR GLASS

Under Alternative B, waste mirror glass and replacement methods would remain the same as under the Proposed Action.

4.6.7.4 HERBICIDES

Under Alternative B, herbicide use would be 35% (24,050 pounds) less than under the Proposed Action.

4.6.7.5 HEAT TRANSFER FLUID

Alternative B would result in a 25% to 30% reduction in the volume of HTF present at the SSEP. Approximately 1,125,000 to 1,050,000 gallons of HTF would be in process within the solar fields and power blocks, a reduction of 375,000 to 450,000 gallons when compared to the Proposed Action. Site-specific plans would remain the same as under the Proposed Action.

4.6.7.6 NATURAL GAS AND GAS DELIVERY

Under Alternative B, the SSEP would use 33% less natural gas than under the Proposed Action, for an annual natural gas usage of approximately 2,600 million standard cubic feet or a maximum of 2,655,000 MMBtu/year. Site-specific plans would remain the same as under the Proposed Action.

4.6.7.7 WATER TREATMENT

Under Alternative B, there would be no change in the amount of water treatment chemicals stored and used at the SSEP as described under the Proposed Action.

4.6.8 *Reduced Water Use Option–Brine Concentrator*

The brine concentrator could be added to either of the action alternatives that would use a wet cooling system (the Proposed Action and Alternative B). No additional hazardous materials would be generated or used at the SSEP under this option.

4.6.9 *Generation Tie Line Option*

The application of the Gen-tie Line Option to any of the action alternatives would not result in the additional generation or use of hazardous materials at the SSEP because the generation or use of additional hazardous materials would not be necessary to implement this option compared to the proposed gen-tie alignment.

4.6.10 *Potential Mitigation Measures*

Measures should be considered to reduce occupational EMF exposures, such as backing electrical generators with iron where practicable to block the EMF, shutting down generators when work is being done near them, and otherwise limiting exposure time and proximity while generators are running.

4.6.11 Residual Impacts

No potential mitigation measures are recommended; therefore impacts would be the same as discussed under the alternatives.

4.6.12 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources.

4.7 Land Use and Access

4.7.1 Analysis Area and Analysis Assumptions

Impacts to land use resulting from the SSEP are analyzed within a 2-mile radius surrounding the Project Area. This distance was selected to account for potential indirect impacts from increased vehicle traffic and impediments to access that would extend beyond the project footprint. The 2-mile radius incorporates the area that would be affected by construction of new roads and utility corridors and by increased traffic. It is assumed that there would be no other use of the Project Area except for renewable energy during the lifetime of the project (30 years). Impacts to land uses in the area of analysis from implementation of the SSEP are discussed in terms of changes to the existing use. Impacts to land uses in the analysis area also consider the degree to which the SSEP would affect proposed future land uses.

4.7.2 No Action

Under the No Action alternative, the BLM land on which the project is proposed would continue to be managed within 1) BLM's framework of a program of multiple use and sustained yield and 2) the maintenance of environmental quality [43 U.S.C. § 1781 (b)] in conformance with applicable statues, regulations, and BLM's land-use plan. Current land uses in the area of analysis would continue under the No Action alternative, and the Project Area would become available to other uses that are consistent with BLM's land-use plan, potentially including another solar project. Current land uses in the area of analysis include cattle grazing, mining, utilities, dispersed recreation, low-density residential, transportation, a regional landfill, and a state prison complex. Land in the immediate vicinity of the Project Area would remain primarily open desert with pockets of agriculture, utilities, and widely dispersed, low-density residential uses on private parcels.

4.7.3 Proposed Action

Under the Proposed Action, all existing land uses would be precluded and replaced with renewable energy production. All uses in the analysis area, but outside the Project Area, would continue in their current manner, except that access to those uses could be interrupted by increased traffic during construction of the SSEP.

The SSEP's primary access would be from SR-85 via Komatke Road and a new access road from the west. Traffic would increase by approximately 1,000 vehicles at the peak of construction, which would last 39 months, and by 82 vehicles during operation, which would last at least 30 years. Commute times would increase for workers and others accessing the mining area and the Jojoba switchyard because they would use the same access roads.

After the Project Area is graded and construction begins, chain-link security fencing would be installed around the site perimeter (approximately 10 miles), switchyard, and other areas requiring controlled access during construction and operation. This would preclude grazing and recreational land uses because there would be no access or use of the Project Area for the life of the project. Construction of the SSEP would result in the conversion of approximately 3,500 acres of land to industrial uses and the closure of 7.4 miles of primitive roads across the Project Area. Construction of the SSEP and closure of some existing roads would reduce motorized and nonmotorized access to adjacent public lands. Other existing roads and public lands adjacent to the Project Area would remain open and continue to provide access to other public lands and the Sonoran Desert National Monument. Visitors would continue to have access to the Sonoran Desert National Monument via Komatke Road and its associated spur roads currently available to public use. Visitors would also continue to have access to Riggs Road to access other public lands and the Sonoran Desert National Monument.

New opportunities to access the public lands would become available with the addition of the well field road and gen-tie access roads. These roads would not be gated, enabling access for the public. The BLM would be encumbered with the enforcement of these new access points.

Under the Proposed Action, the BLM would issue a ROW grant to allow the SSEP on federally managed lands. Because the SSEP ROW must conform to the terms and conditions of previously issued ROWs in the Project Area, there would be no direct impacts to these rights. Direct or indirect impacts of the Proposed Action on pending or conceptual ROW and potential impacts to access and other future proposed land uses are described in Section 4.20.4.6 (Cumulative Impacts).

Approximately 69 acres of the project footprint overlap the Wesco Mining Claim. Because the mining plan of operations and the claim pre-date the SSEP application, and Wesco has maintained a validly filed mining claim, the existing mining operation would be an encumbrance on subsequent land uses, including the SSEP. BLM can authorize a ROW overlapping the claim if the plans of operation are not in conflict. The 69 acres would represent an impact only if the BLM authorizes a ROW that would overlap the mining plan of operations for the next 30 years, thereby precluding mining activities (assuming the mining claimant would agree). Table 4.49 summarizes the impacts to land uses for the project.

Table 4.49 Impacts to Land Uses from the SSEP

Affected Land Use	Impact
Grazing	Loss of approximately 3,500 acres due to project facility occupation and loss of plant productivity and access to forage
Recreation (hunting, hiking, equestrian use, motorized travel)	Loss of approximately 3,500 acres and 7.4 miles of primitive roads due to project facility occupation and loss of access to recreational opportunities
Utility corridors (electrical transmission, natural gas pipeline)	No anticipated impacts from the addition of new utilities to the existing corridors
Mining (sand and gravel)	Loss of 69 acres for mining if BLM authorizes a ROW that overlaps the mining plan of operation
Residential	Adverse impacts from 30–60 trucks per day during construction to the local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience.(see Section 4.12 for more information)
Commercial and industrial	No impact
Airport/public/quasi-public	No impact

4.7.3.1 CONSISTENCY WITH OTHER APPLICABLE LAND-USE PLANS

According to Arizona statute, the Arizona Corporation Commission requires review of the general land-use plans within 2 miles of the proposed power plant site (Arizona Department of State 1975). In its review of siting factors, the Power Plant and Transmission Line Siting Committee must consider potential impacts to the existing plans of the state, local government, and private entities for other developments.

Table 4.50 outlines the plans that are applicable within the area of analysis, their goals and objectives, and the consistency of those plans with implementation of the Proposed Action (Also refer to Chapter 1 Section 1.6).

Table 4.50 Consistency of the Proposed Action with Applicable Federal and Local Plans

Plan	Goals/Objectives/Policy	Consistency Determination
BLM Lower Gila South Resource Management Plan	Directs BLM to consider renewable resources—specifically solar energy development—when undertaking the land-use planning process.	Consistent because the RMP provides opportunities for multiple land uses in the Project Area, including renewable energy projects.
City of Goodyear General Plan	"Attempts to strike the necessary balance between suburban and urban development while retaining the elements of the City's agricultural and natural character. Environmental and Energy Conservation projects would be considered even if baseline densities were exceeded" (City of Goodyear 2003).	Consistent because the plan encourages energy conservation and a balance between suburban and urban development, which would allow consideration of a solar facility.
Maricopa County Comprehensive Plan	Supports innovative technological operations and facilities to "encourage … energy efficiency and the use of renewable resources" (Maricopa County 2002).	Consistent because it encourages the use of renewable resources.
Town of Buckeye General Plan	Goal 10.0 Use Energy Efficiently and Maximize Sustainability states "Utilize renewable resources over nonrenewable resources" and "Encourage renewable energy sources, such as solar and wind."	Consistent because it encourages the use of renewable resources; inconsistent because the Project Area is zoned by the Town of Buckeye as "rural-residential." However, the land in question is federally owned and managed by the BLM. Therefore, Buckeye's "rural residential" zoning classification is not applicable to this area.

4.7.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts under Alternative A would be the same as under the Proposed Action, because Alternative A would occupy the same footprint as the Proposed Action (with the exception of two well sites). The number of acres that would be fenced and converted to an industrial land use to accommodate the project footprint would be the same, as would the number of miles (7.4 miles) of primitive roads closed to motorized travel in the Project Area. The loss of access (7.4 miles) and the conversion of land use (3,500 acres) would be the same under Alternative A as under the Proposed Action.

4.7.5 Sub-alternative A1: Photovoltaic

Impacts to land use and access under Sub-alternative A1 would be less than under the Proposed Action, primarily due to the sub-alternative's smaller solar-field footprint (approximately 1,907 acres, or 51% smaller than the Proposed Action). All other land uses in the Project Area would be precluded by the SSEP. Land uses in the analysis area but outside the Project Area would not be precluded by the SSEP and would continue; however, access would be temporarily impacted during construction due to the increase in traffic (see Section 4.15).

Under Sub-alternative A1, primary access would be the same as under the Proposed Action. Traffic would increase by approximately 267 vehicles at the peak of construction, which would last 39 months, and by 16 vehicles during operation, which would last at least 30 years. Commute times during construction would increase for workers and others accessing the mining area and the Jojoba Switchyard, because they would use the same access roads as those used for project construction. Due to the expected increase of 267 weekday construction trips, the LOS of the Riggs Road/SR-85 would be reduced from LOS B to LOS C.

There would be no impact to the commute time for workers and others accessing the mining area and the Jojoba Switchyard during operation and maintenance because the 16 weekday operation trips would not decrease the LOS of the Riggs Road/SR-85 intersection.

After the Project Area is graded and construction begins, chain-link security fencing would be installed around the site perimeter (approximately 6 miles), switchyard, and other areas requiring controlled access during construction and operation. This would preclude grazing and recreational land uses because there would be no access or use of the Project Area for the life of the project. Construction of the SSEP under Sub-alternative A1 would result in the conversion of approximately 1,907 acres of land to industrial uses and the closure of approximately 3 miles of primitive roads across the Project Area. This would reduce motorized and nonmotorized access to adjacent public lands (including Sonoran Desert National Monument). Other existing roads and public lands adjacent to the Project Area would remain open and continue to provide access to other public lands (including Sonoran Desert National Monument).

Table 4.51 summarizes the impacts to land uses for Sub-alternative A1.

Table 4.51 Impacts to Land Uses from the SSEP – Sub-alternative A1

Affected Land Use	Impact
Grazing	Loss of approximately 1,800 acres due to project facility occupation and loss of plant productivity and access to forage.
Recreation (hunting, hiking, equestrian use, motorized travel)	Loss of approximately 1,800 acres and approximately 3 miles of primitive roads due to project facility occupation and loss of access to recreational opportunities.
Utility corridors (electrical transmission, natural gas pipeline)	No anticipated impacts from the addition of new utilities to the existing corridors.
Mining (sand and gravel)	No impact.
Residential	Adverse impacts to the local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience (see Section 4.12 for more information).
Commercial and industrial	No impact.
Airport/public/quasi-public	No impact.

Consistency with other relevant plans under Sub-alternative A1 would be the same as under the Proposed Action.

4.7.6 Alternative B: Reduced Footprint

Impacts under Alternative B would be of the same nature as those described under the Proposed Action; however, 2,300 acres (instead of 3,500 acres) would be fenced and converted from the existing land uses to an industrial land use for renewable energy production and 3.7 miles of road would be closed to motorized travel in the Project Area (instead of 7.4 miles). Alternative B would therefore result in a 37% smaller conversion of land use than the Proposed Action. Access would be impeded for two fewer months than under the Proposed Action, because the construction period under this alternative would be two months shorter. Fifteen acres of the Wesco Mining Claim would be precluded from use for the life of the project under Alternative B if the BLM issues an overlapping ROW for the SSEP; 54 fewer acres than under the Proposed Action.

4.7.7 Reduced Water Use Option–Brine Concentrator

The reduced water use option would not change the affect of the Proposed Action or Alternative B on other land uses or access, because the brine concentrator component of the facility would be constructed within the proposed facility footprint under both alternatives. No additional land would be needed to add this option to the alternative.

4.7.8 Generation Tie Line Option

If the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B, an additional 8.3 acres would be converted from existing land uses to an industrial land use for renewable energy production. If the Gen-tie Line Option were selected in combination with Sub-alternative A1, an additional 11.4 acres of land would be disturbed and converted to an industrial land use. Total surface disturbance and conversion of land to an industrial use would increase by no more than 0.56% if the Gen-tie Line Option were selected, depending on the alternative it is combined with. Land use and access impacts would otherwise be the same as those described above.

When compared to the proposed gen-tie line alignment, the Gen-tie Line Option would disturb approximately 1.1 more acres of the Wesco Mining Claim if it were applied to any of the action alternatives. For the Proposed Action and Alternative A, this is a 1.6% increase in surface disturbance in the Wesco Mining Claim (70.1 acres of total disturbance with the Gen-tie Line Option applied to these alternatives). For Alternative B and Sub-alternative A1, this is a 7.3% increase in surface disturbance in the Wesco Mining Claim (16.1 acres of total disturbance with the Gen-tie Line Option applied to these alternatives).

4.7.9 Potential Mitigation Measures

No potential mitigation measures are suggested.

4.7.10 Residual Impacts

Because no potential mitigation measures are suggested, the residual impacts to land use and access would be the same as discussed under all action alternatives.

4.7.11 Short-term Uses versus Long-term Productivity

Under all action alternatives, project lands would be converted from their existing land uses to renewable energy production. The current productivity of the land within the SSEP footprint for grazing and dispersed recreation would be unavailable for as long as the SSEP is in operation. Although there would be a loss in the capability of the Project Area to provide for (produce) grazing and recreation, the new industrial land use would produce renewable energy.

4.7.12 Irreversible and Irretrievable Commitments of Resources

There would be an irretrievable loss of grazing and recreational uses from the SSEP, because the Project Area would be graded and fenced, and those uses would be precluded for the life of the project. There would also be an irretrievable loss of mining land if the BLM issues an overlapping ROW for the SSEP. There would be no irreversible commitments of resources, because the area would be reclaimed after termination of the project and these uses could then be reestablished.

4.8 Livestock Grazing

4.8.1 Analysis Area and Analysis Assumptions

The analysis area for livestock grazing, as described in Chapter 3, is the project footprint, consisting of approximately 3,620 acres of land. Impacts to grazing would consist of acres of forage lost as a result of implementation of the project, which would result in a loss of animal unit months (AUMs). Loss of access to forage due to fencing and potential livestock mortality from vehicle strikes due to increased traffic is also discussed.

4.8.2 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses (grazing, dispersed recreation, and utility ROWs) would continue. The portion of the Arnold grazing allotment (1,053 acres) in the Project Area would continue to be used for ephemeral grazing. Authorized grazing would continue on the 2,649 acres of the Beloat grazing allotment in the Project Area. The stock pond would remain, allowing cattle to travel farther to reach forage.

4.8.3 Proposed Action

Under the Proposed Action, site preparation would include the removal of all vegetation from the Project Area for the duration of the project. Vegetation removal would be maintained through the application of approved herbicides and, where needed, mechanical removal. Because the vegetation would be removed and the area would be fenced, livestock would no longer be able to graze from vegetation communities associated with the site. Fencing and grading the area would remove 971acres of the Arnold allotment (4.2% of the total allotment acreage of 23,390 acres) from livestock grazing use for the life of the SSEP. Fencing and grading would also remove 2,649 acres (2.6% of the total allotment acreage of 103,508 acres) of the Beloat allotment from livestock grazing use for the life of the SSEP.

Because the public land in the Project Area is used for two grazing allotments, implementation of the Proposed Action would reduce the amount of forage available for livestock grazing. BLM estimates that the total number of AUMs associated with the approximately 3,620-acre Project Area is 122; 44 AUMs for the Arnold allotment and 78 AUMs for the Beloat allotment. Implementation of the Proposed Action would include fencing of the entire project footprint and removal of vegetation, eliminating any potential use of the 122 AUMs on the Project Area for livestock grazing during the life of the project.

A stock pond (the CCC stock tank) is located in the eastern portion of the Project Area. Construction and operation of the SSEP would result in the loss of that water source due to vegetation clearing and leveling for construction of solar troughs. Because the stock pond allows the cattle to travel farther to reach forage in the area, this would have an adverse impact to grazing.

Increased traffic associated with the construction and operation of the SSEP would increase the risk of injury or death to individual cattle through vehicle strikes if cattle are grazing in the area. A variety of safety-related plans and programs would be implemented to ensure human health and safety (see Section 2.3.2). These measures would also help reduce the likelihood that livestock would be threatened by injury or death during the construction and operation of the SSEP. Also, fugitive dust control would decrease the amount of dust on vegetation adjacent to the Project Area, which has been shown to render forage unpalatable in some cases.

4.8.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts to livestock grazing under Alternative A would be the same as under the Proposed Action because the project footprint would be of identical size, resulting in an equal loss of forage. As with the Proposed Action, the project site would be fenced and the stock pond destroyed, thereby limiting access to forage.

4.8.5 Sub-alternative A1: Photovoltaic

Impacts to livestock grazing under Sub-alternative A1 would be less than under the Proposed Action because the project footprint would be 2,013 acres (approximately 44%) less than the Proposed Action. This represents a permanent reduction (compared to the No Action alternative) in acres available for grazing of 1,051 acres (1.0% of the total allotment acreage) and 932 acres (4.0% of the total allotment acreage) in the Beloat allotment and Arnold allotment, respectively. Further, this represents a reduction (compared to the No Action alternative) in forage of 31 AUMs and 39 AUMs in the Beloat and Arnold allotments, respectively. Unlike the Proposed Action, under Sub-alternative A1 the CCC stock tank described above would fall outside the Project Area and would be available for livestock use.

4.8.6 Alternative B: Reduced Footprint

Impacts to livestock grazing under Alternative B would be largely the same as under the Proposed Action, except the project footprint would be 2,394 acres, which is 34% less than under the Proposed Action. This represents a reduction (compared to the No Action alternative) in acres available for grazing of 1,397 acres (1.3 % of the total allotment acreage) and 966 acres (4.2% of the total allotment acreage) in the Beloat allotment and Arnold allotment, respectively. Further, this represents a reduction (compared to the No Action alternative) in forage of 38 AUMs and 41 AUMs in the Beloat and Arnold allotments, respectively.

Unlike under the Proposed Action, under Alternative B, the CCC stock tank described above would fall outside the Project Area and would be available for livestock use.

4.8.7 Reduced Water Use Option–Brine Concentrator

Impacts to livestock grazing under this option would be the same as under the Proposed Action and Alternative A, because the project footprint under these alternatives would not change if a brine concentrator were employed to reduce water use.

4.8.8 Generation Tie Line Option

The nature of impacts to livestock grazing under the Gen-tie Line Option would be the same as previously described for the action alternatives. An additional reduction of grazing availability on the Arnold allotment of 8.3 acres would occur if the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B. This represents less than a 1% change in grazing availability on this allotment under any of these alternatives. If the Gen-tie Line Option were selected in combination with Sub-alternative A1, a reduction of 11.4 acres of grazing availability in the Arnold allotment would occur (Table 4.52). This also represents less than a 1% change in grazing availability on this allotment under this alternative. Impacts to the Beloat allotment would not change if the Gen-tie Line Option were selected in combination with any action alternative because no part of the Gen-tie Line Option would be constructed on the Beloat allotment.

Table 4.52 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Livestock Grazing	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Arnold allotment		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.8.9 Potential Mitigation Measures

The additional protective measures described here would minimize or eliminate impacts to livestock from direct and indirect disturbances associated with the Proposed Action and action alternatives. These mitigation measures would help to reduce or eliminate impacts to livestock from access roads and increased traffic.

- The stock pond that would be removed during construction and operation of the SSEP under the Proposed Action and Alternative A would be rebuilt in a nearby location outside of the Project Area if one of these alternatives were selected by the BLM. A rebuilt stock pond would allow cattle to continue accessing the forage in the area. The stock pond would be appropriately sited in an area similar to the original stock pond location and would be constructed according to BLM standards. Range improvements such as stock ponds may be authorized under the terms and conditions of existing grazing permits or leases, but can also be authorized through a BLM Cooperative Range Improvement Agreement or a Range Improvement Permit. Impacts from the rebuilt stock pond would be addressed through such an agreement or permit with the BLM.
- Speed limits would be posted along access roads and strict adherence to posted speed limits would be enforced.

4.8.10 Residual Impacts

Rebuilding the stock pond would allow cattle to continue to forage in the area. Residual impacts would include the temporary loss of access to local forage and a change in cattle foraging habits during the interval between the removal of the existing stock pond and the construction of a new pond (because water is a limiting factor on cattle movement). In addition, cattle foraging habits may be permanently altered by the new stock pond location. This is because the grazing process is influenced by livestock's diet selection and the animals' physiological needs such as water or thermal regulation (e.g. shade) (Heitschmidt and Stuth 1991). The localized impact of grazing on vegetation and soils (i.e., livestock foraging) tends to dissipate with distance from points of concentration such as water (Washington-Allen et al. 2004). Livestock would likely forage outward from the new stock pond location, which would change the pattern of previous foraging around the old stock pond.

Posted speed limits along access roads and strict adherence to speed limits would reduce impacts to livestock from vehicle strikes. Fencing of access roads would further reduce impacts to cattle from vehicle strikes. However, approximately 25% of the forage in the Arnold allotment would be lost if the area were fenced, and would reduce livestock access to those forage resources as a result.

4.8.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP (the short-term use) would affect the long-term vegetation productivity of the Project Area because of vegetation removal. During construction of the SSEP vegetation removal would occur to facilitate placement of project facilities on the landscape. During project operations vegetation would not be allowed to reestablish within the bulk of the Project Area. At project decommissioning the Project Area would be reclaimed. However, the loss of the vegetation communities and forage productivity that occurred during project operations would persist for a time (approximately 10 years) until vegetation is reestablished and again available for forage.

4.8.12 Irreversible and Irretrievable Commitments of Resources

Long-term surface-disturbing activities and complete removal of forage associated with construction and operation of the SSEP would result in irretrievable commitments of livestock grazing resources for the life of the project and a period of approximately 10 years following project decommissioning because vegetation would be physically removed from the area to facilitate project construction and operations. There would be no irreversible impacts to livestock grazing resources because the area would be reclaimed and revegetated after the project and ephemeral grazing could be reinstated.

4.9 Noise

4.9.1 Analysis Area and Analysis Assumptions

The area of analysis for noise is approximately 14,750 acres and consists of the Project Area, vacant BLM-managed desert land (see Map 15), adjacent residential areas, the Buckeye Hills Regional Park, portions of the Sonoran Desert National Monument, and portions of the North Maricopa Mountains Wilderness. The relative direct and indirect impacts of each alternative to noise receptors were assessed by comparing changes in ambient noise levels from the construction and operation of the SSEP. Four different alternatives and one sub-alternative are analyzed in this section, including the No Action and Proposed Action. Each alternative presents a varying degree of impacts to noise receptors in the area of analysis.

For conservatism, and as is standard practice in the description of environmental noise, the noise modeling assumed stable atmospheric conditions (suitable for reproducible measurements) that are favorable for propagation. In addition, other sound attenuation factors, such as source directivity, air absorption, ground effects, and barrier/shielding, are commonly ignored for construction noise and commonly yield a conservative result. These factors in the modeling process tend to predict higher values than would be expected in the real-world environment around the site.

Several of the noise receptors are more than 1 mile from the site; at these distances, ground attenuation would be substantial. However, ground attenuation was excluded from construction noise propagation analyses for conservatism. Furthermore, the sound levels presented in the analysis are those that would be experienced by people outdoors. A building provides significant attenuation for those who are indoors. Sound levels can be expected to be as much as 27 dBA lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (EPA 1974).

For reference, a 1-dBA increase or decrease is a nonperceptible change in an environmental sound level (American Society of Heating, Refrigerating and Air Conditioning Engineers [ASHRAE] 1989). An increase of 3 dBA in environmental sound levels outdoors may or may not be distinguishable to the average person (ASHRAE 1989). A 5-dBA increase or decrease is a clearly discernible sound level change in an outdoor environment (ASHRAE 1989). Noise level increases below 3 dBA are commonly held as being inaudible for general environmental noise assessments. As noted in Section 3.9.3 (Fundamentals of Acoustics), intrusive noise is defined as noise that intrudes over and above the existing ambient condition at a given location. Finally, it is assumed that all noise from the operation and construction of SSEP would dissipate within 1.75 miles of the source[4] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions.

Noise emissions are regulated by Maricopa County, the State of Arizona, EPA, and OSHA. It is assumed that the Proposed Action and alternatives would comply with all federal, state, and local noise regulations, requirements, and ordinances during both the construction and operation phases of the SSEP. However, as described in Section 3.9.2.3.1, the following are exempt from County Ordinance P-23: 1) noise emanating from power plant equipment during normal operations; and 2) noise emanating from construction and repair equipment when used in compliance with existing Maricopa County rules and regulations. It is assumed that a hearing protection plan for workers and visitors would be part of the health and safety plan and would comply with Arizona OSHA and United States OSHA requirements. The analysis of noise to

[4] The assumption that noise usually dissipates to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 = 50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA) and is the assumed distance for dissipation of noise to background levels for this analysis.

biological resources addresses potential impacts of the presence and noise of construction and operation of the SSEP on wildlife and their lifecycles. Additional information concerning the effects of noise on biological resources may be found in Section 4.19.

4.9.2 No Action

Existing noise sources in the area of analysis consist of sporadic vehicle traffic, small machinery, distant aircraft, and natural sounds from wind, rustling vegetation, birds, and insects. Under the No Action alternative, current ambient noise levels in the area of analysis would continue to be influenced by these factors, and the sound conditions would remain quiet. The 24-hour L_{eq} levels recorded at Hayes Road, Baseline Road, and the Sonoran Desert National Monument were 47.6, 46.4, and 39.7 L_{eq}, respectively, and sound conditions in the area of analysis under the No Action alternative would not exceed this level.

4.9.3 Proposed Action

4.9.3.1 CONSTRUCTION

Project construction would occur in a phased schedule over a 39-month period. The main sources of noise and, potentially, vibration would be the large equipment pieces used during the primary phases of construction (i.e., site clearing/grading, excavation, foundations, building and erection, and finishing). Heavy equipment used during construction would typically include dozers, loaders, graders, power shovels, cranes, haul trucks, and generators. The noise and vibration levels from construction activities would vary during the different activity periods, depending on the activity location(s) and the number and types of equipment in operation. To analyze the construction noise impacts of the SSEP, the combined noise emissions of activities associated with site grading, power block construction, and solar field build-out were defined based on standard noise emission ratings. Additionally, because the construction zone is widely spaced, several areas of activity were defined as representative locations for construction noise evaluations (Mantee 2009). The following actions would be implemented as part of the construction phase of the Proposed Action and would result in increased ambient noise levels at some receptor locations in the area of analysis.

- Construction vehicle traffic
- Construction equipment operation
- Soil compaction
- Venting during site commissioning

Construction vehicle traffic would consist of workers traveling to and from the Project Area and haul trucks carrying equipment, supplies, and materials in and out of the Project Area. At the peak of construction, 1,000 vehicles would access the Project Area on a daily basis. Primary access for construction would be via SR-85. Some traffic would use the Rainbow Valley Road/Riggs Road, but this would be light when compared to SR-85 traffic flows. Noise from worker vehicles would be similar to the sound of existing traffic on SR-85. Haul trucks have the potential to generate noise levels as high as 80 dBA at a distance of 50 feet from the roadway. Assuming an hourly haul truck volume of 25 vehicle trips (12 to 13 trucks entering the site and then leaving again) and a vehicle speed of 25 mph, the hourly average noise level (L_{eq}) generated by haul trucks for the SSEP during construction would be approximately 62 dBA at a distance of 50 feet from the source (Mantee 2009).

Table 4.53 presents standard noise levels from common construction equipment at various distances. These typical noise levels do not account for attenuation from air absorption, ground effects, and shielding from intervening topography or structures.

Table 4.53 Noise Levels from Common Construction Equipment

Construction Equipment	Typical Sound Pressure Level (dBA)				
	50 feet	100 feet	500 feet	1,500 feet	3,000 feet
Dozer (250–700 hp)	88	82	68	58	52
Front end loader (6–15 cubic yards)	88	82	68	58	52
Trucks (200–400 hp)	86	80	66	56	50
Grader (13 to 16 feet blade)	85	79	65	55	49
Shovels (2–5 cubic yards)	84	78	64	54	48
Portable generators (50–200 kW)	84	78	64	54	48
Derrick crane (11–20 tons)	83	77	63	53	47
Mobile crane (11–20 tons)	83	77	63	53	47
Concrete pumps (30–150 cubic yards)	81	75	61	51	45
Tractor (0.75 to 2.00 cubic yards.)	80	74	60	50	44
Un-quieted paving breaker	80	74	60	50	44
Quieted paving breaker	73	67	53	43	36

Source: EPA (1971); Barnes et al. (1976).

Notes: These typical noise levels at distances away from the equipment item (beyond 50 feet) are conservative because the only attenuating mechanism considered was divergence of the sound waves in open air. In general, this mechanism results in a 6-dBA decrease in the sound level with every doubling of distance from the source. For example, the 84-dBA average sound level associated with generators would be attenuated to 78 dBA at 100 feet, 72 dBA at 200 feet, 66 dBA at 400 feet, and so forth. Attenuation from air absorption, ground effects, and shielding from intervening topography or structures are not included in these nominal values. Further, use of these data is considered to be conservative because the evolution of construction equipment has been toward quieter designs to protect both operators from exposure to high noise levels and the community from undue noise intrusion.

Noise levels that would occur from construction activities associated with the Proposed Action are described in Table 4.54. Short-term noise receptors (ST) consist of institutional, residential, and recreational sites. Long-term noise receptors (LT) consist of both residential and recreational sites (see Map 15). Construction-related noise would range between 34 dBA and 54 dBA during the busiest periods of activity at each of the receptor locations. As noted in Chapter 3, any sound level 40 dBA and below gives the subjective impression of quiet.

Table 4.54 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Aggregate construction noise level at 50 Feet (dBA)			91	90	93	93	90
Institutional	ST-1	Ambient	63	63	63	63	63
		Construction	38	34	37	37	37
Residential	ST-2	Ambient	34	34	34	34	34
		Construction	54	51	54	54	53
	LT-2	Ambient	46	46	46	46	46
		Construction	43	39	42	42	42
	LT-1	Ambient	48	48	48	48	48
		Construction	53	47	50	50	52
Recreational	ST-3	Ambient	28	28	28	28	28
		Construction	40	35	38	38	39
	LT-3	Ambient	40	40	40	40	40
		Construction	44	39	42	42	43
	RBWA	Ambient	–	–	–	–	–
		Construction	37	33	36	36	36
	BHRP	Ambient	–	–	–	–	–
		Construction	39	35	38	38	38

Source: EPA (1971); Mantee (2009).

Notes: The aggregated noise levels, using the EPA methodology, were propagated over the various distances to each receptor using only spreading loss attenuation (6 dBA/DD [doubling of distance]). These typical noise levels do not account for attenuation from air absorption, ground effects, and shielding from topography or structures.

The choice of representative subareas for any given construction phase would result in different distances to each receptor, thus different summed noise levels. All ambient noise levels were rounded to zero decimals.

There are no ambient data for RBWA and BHRP.

RBWA = Robbins Butte Wildlife Area (NW of Project Area).

BHRP = Buckeye Hills Regional Park (WNW of Project Area).

The noise levels presented in Table 4.54 are those that would be experienced by people outdoors. Sound levels can be as much as 27 dBA lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (EPA 1974).

In addition to the areas of activity defined for construction noise evaluation (Mantee 2009), construction equipment would operate intermittently outside those areas of activity at sites close to noise receptors. The residence at ST-2 is approximately 1,630 feet from the Project Area boundary. Because a solar collector field would be located near the Proposed Action's Project Area boundary, it is assumed that one or more graders and/or dozers would operate within 0.5 mile of this representative residential structure. Exterior noise levels in the range of 60 to 63 dBA would be experienced at this residence for those periods when construction activities are occurring in that area.

Construction activities associated with the Proposed Action would result in ground vibration. These activities would include truck movements and soil compaction during grading activities. These sources would not result in a measurable increase in vibration levels at any receptor.

Intermittent increases in noise during the SSEP start-up and commissioning would result from air and steam venting. Ventings are necessary as part of the line-cleaning process prior to start-up. During venting, high-pressure steam (or air) is allowed to escape through an outlet in the piping. Commissioning and initial start-up would last two to three weeks between the end of construction and the beginning of commercial operations. A series of short steam blows, lasting two or three minutes each, may be performed several times daily over that two- to three-week period. Ventings can be as loud as 130 dBA at a distance of 100 feet. Temporary vent silencers would be used during this period to reduce the noise levels by 20 to 30 dBA. In addition to the planned and controlled line-cleaning discharges, the commissioning and initial start-up phase could also include steam releases during a system trip or during shutdown. Shutdowns occur as a result of an undesirable configuration or condition of the steam turbine or other pressurized system. The frequency, duration, and magnitude of these events are variable, depending on the particular plant conditions at the time.

Construction activities associated with the Proposed Action would generate measurable, short-term increases in ambient noise levels. Construction noise levels would be comparable to or above the existing ambient noise levels at the receptor locations. Some construction phases would not be audible during the typical daytime hours as a result of distances involved (e.g., all receptors would be over 2 miles away from the activities at the 250-MW power block). The noise level from a silenced steam blow venting would be 100 dBA at 100 feet from the outlet. As a result of 1) distance attenuation, 2) air absorption and ground effects, and 3) noise attenuation related to being indoors, the closest receptor (ST-2) would experience noise levels of approximately 35 dBA indoors.

4.9.3.2 OPERATIONS

To analyze the operational noise impacts of the SSEP, a proprietary, computerized noise prediction program was used to simulate and model the noise propagation from the SSEP (Mantee 2009). The following actions that would occur during operations of the Proposed Action were analyzed:

- Operations traffic
- Equipment vibration
- Operation of power blocks
- Transmission line
- Switchyard

Operations traffic would be intermittent and would be primarily from workers' vehicles and delivery trucks traveling to and from the SSEP. The SSEP is expected to have approximately 80 full-time employees. As with the construction phase, operations traffic is expected to access the site from the west, via SR-85. Given the distance (1 to 3 miles or more) to the nearest noise-sensitive receptors, operations traffic would not result in an increase in ambient noise levels at noise-sensitive receptors.

Rotating machinery within the power block would contribute to ground vibration in the immediate vicinity of the equipment. Vibration-monitoring systems installed in the equipment are designed to ensure that the equipment remains balanced and reduces ground vibration. The nearest noise-sensitive receptors are 0.9 mile or more from the proposed SSEP power block. At these distances, SSEP generated vibration energy would be undetectable.

There are two planned power blocks for the SSEP plus associated solar fields enabling the generation of 250 MW (west block) and 125 MW (east block) of electricity. Outdoor noise levels throughout the power blocks would range from 90 dBA near certain groups of equipment to 65 dBA in areas farther away from noise sources. Because there would be minimal noise sources operating in the solar arrays, outdoor noise levels in the arrays of solar troughs would be similar to existing ambient levels and would not exceed 50 dBA. For daytime operations, either with the boiler option or the fired heater option, noise levels would be at or below existing conditions at the following locations: LT-1, LT-2, LT-3, ST-1, ST-3, Buckeye Hills Regional Park, and Robbins Butte Wildlife Area. At ST-2 (the closest receptor to a proposed power block), SSEP daytime contributions would be 5–7 dBA above hourly average noise levels (L_{eq}) (Table 4.55). There is additional residential land between the Project Area and noise receptor ST-2, and a 5–7 dBA increase in ambient noise could be an irritant on this residential land depending on the noise characteristics given the very low existing ambient noise levels. However, ground attenuation could reduce the SSEP's contributions to 1–3 dBA above daytime ambient noise levels depending on environmental conditions such as wind speed and direction. Please see Tables 3.23 and 3.24 for details on ambient noise levels. For nighttime operations, noise contributions from the SSEP would not be expected to exceed the existing conditions at any receptor analysis locations. Table 4.55 lists the day and nighttime noise levels for project operations[6].

Table 4.55 Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Site Type and Noise Receptor		Noise Levels	Predicted Daytime Project Noise Level, (dBA); Boiler Option	Predicted Daytime Project Noise Level, (dBA); Fired Heater Option	Predicted Nighttime Project Noise Level, (dBA); Either Option
Institutional	ST-1	Ambient	63	63	63
		Operations	16	16	0
Residential	ST-2	Ambient	34	34	34
		Operations	41	42	28
	LT-2	Ambient	46	46	46
		Operations	25	26	6
	LT-1	Ambient	48	48	48
		Operations	35	35	23

[6] Ambient and construction/operations noise levels are not additive.

Table 4.55 Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Site Type and Noise Receptor		Noise Levels	Predicted Daytime Project Noise Level, (dBA); Boiler Option	Predicted Daytime Project Noise Level, (dBA); Fired Heater Option	Predicted Nighttime Project Noise Level, (dBA); Either Option
Recreational	ST-3	Ambient	28	28	28
		Operations	21	21	4
	LT-3	Ambient	40	40	40
		Operations	27	27	11
	RBWA	Ambient	–	–	–
		Operations	11	11	0
	BHRP	Ambient	–	–	–
		Operations	18	19	0

Source: Mantee (2009).
Notes:
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).
There are no ambient data for RBWA and BHRP.

During operations, steam releases can occur as a result of emergency pressure safety valve discharges. Steam by-pass systems are designed into modern power plants, like the SSEP, so that emergency pressure overages can be successfully managed with process control systems, making discharges a rare event. When a pressure safety valve discharge does occur, it can produce high noise levels at the discharge point. Outdoor receptors within approximately 3,000 feet of the plant would experience clearly audible noise levels of short duration.

During plant operations, the on-site switchyard electrical equipment would emit an audible hum from transformer and switching equipment. Additionally, the transmission line would also emit an audible hum. The switchyard would be located within the power block, more than 1 mile from noise-sensitive receptors and would not generate sufficient noise levels to contribute to the other SSEP noise sources. No increase in ambient noise levels at noise-sensitive receptors would occur from the operation of the SSEP transmission line and switchyard.

4.9.4 Alternative A: Reduced Water Use (dry-cooled CST)

4.9.4.1 CONSTRUCTION

Because construction activities would remain the same as the Proposed Action under Alternative A, changes in ambient noise levels from construction activities associated with Alternative A would be the same as those described for the Proposed Action.

4.9.4.2 OPERATIONS

Changes in ambient noise levels from operations associated with Alternative A would be the same as those described for the Proposed Action because the operational components and activities of the SSEP

that generate sound under this alternative would be essentially the same as those described under the Proposed Action.

4.9.5 Sub-alternative A1: Photovoltaic

Under this sub-alternative, the project footprint would only occupy the footprint of the 250-MW power block. As such, the distance between power plant equipment and potential receptors to the northeast, east, and southeast would be less than under the Proposed Action. Unlike the other alternatives, which propose using thermal transfer technology to drive a steam turbine generator to produce power, Sub-alternative A1 would have no rotating machinery and would need no cooling systems. Without rotating machinery for electricity generation, the major noise sources from Sub-alternative A1 would be the various transformers throughout the collection field and the main transformer within the Sub-alternative A1 substation. Noise reduction features for these transformers, if needed, would primarily involve enclosures and/or localized barriers or noise emissions limits from the equipment suppliers. During the detailed engineering phase of Sub-alternative A1, the electrical equipment would be evaluated to determine and update the noise control strategies necessary to support the overall acoustical design of Sub-alternative A1.

4.9.5.1 CONSTRUCTION

The construction process under Sub-alternative A1 would be the largely the same as under the Proposed Action and would be conducted over approximately 39 months. The primary difference between the construction process under Sub-alternative A1 compared to the other action alternatives is that the use of vibratory pile driving methods may be needed for a portion of post foundations for the PV panels[7].

Noise levels that would occur from construction activities associated with Sub-alternative A1 are shown in Table 4.56. Receptor locations are shown on Map 15. Construction-related noise would range from 34 dBA to 46 dBA during the busiest periods of activity at each receptor location.

Table 4.56 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Sub-alternative A1

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Aggregate construction noise level at 50 feet (dBA)			91	90	93	93	90
Institutional	ST-1	Ambient	63	63	63	63	63
		Construction	36	36	39	39	35
Residential	ST-2	Ambient	34	34	34	34	34
		Construction	46	38	41	41	45
	LT-2	Ambient	46	46	46	46	46
		Construction	39	34	37	37	38
	LT-1	Ambient	48	48	48	48	48
		Construction	46	38	41	41	45

[7] These post foundations, similar to guard rail post installations, would entail vibratory pile driving to embed piers to a depth of 10–15 feet, depending on soil conditions and geotechnical engineering recommendations.

Table 4.56 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Sub-alternative A1

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Recreational	ST-3	Ambient	28	28	28	28	28
		Construction	36	35	36	36	35
	LT-3	Ambient	40	40	40	40	40
		Construction	41	39	42	42	40
	RBWA	Ambient	–	–	–	–	–
		Construction	35	34	37	37	34
	BHRP	Ambient	–	–	–	–	–
		Construction	37	37	40	40	36

Source: EPA (1971); Mantee (2009).

Notes: The aggregated noise levels, using the EPA methodology, were propagated over the various distances to each receptor using only spreading loss attenuation (6 dBA/DD).

The choice of representative subareas for any given construction phase would result in different distances to each receptor, thus different summed noise levels.

RBWA = Robbins Butte Wildlife Area (NW of Project Area).

BHRP = Buckeye Hills Regional Park (WNW of Project Area).

There are no ambient data for RBWA and BHRP.

As shown in Table 4.56, some of the noise receptors would be expected to have construction-related noise levels that may be above ambient noise levels during the busiest periods of construction activity. In general, these results are roughly comparable, but typically lower than the predictions for the Proposed Action.

The residence at ST-2 is approximately 8,000 feet from the nearest PV panel and 9,000 feet from the subarea noise center. Because one or more graders and/or dozers may be moving dirt at the edge of the solar field closest to ST-2, exterior noise levels that are 1–2 dB higher than the tabled values may be experienced at this residence when these types of machines are working in this area. As they finish, the equipment would be moved further away to other parts of the solar field, and their noise contributions would reduce to levels more represented by the spatially averaged results given in Table 4.56.

Construction traffic noise for Sub-alternative A1 would not differ from the Proposed Action. Please refer to Section 4.9.3.1 (Construction) for a complete discussion of construction traffic noise impacts.

Construction activities associated with Sub-alternative A1 would result in ground vibration. These activities would include truck movements and soil compaction during grading activities. These sources would not result in a measurable increase in vibration levels at any receptor.

Once Sub-alternative A1 construction is completed, the start-up and commissioning phase would begin in preparation for commercial operations. Unlike the Proposed Action, which would use steam production, condensation processes, and would involve air and steam venting during commissioning, there would be no such venting occurrences during the start-up of Sub-alternative A1. Likewise, without the steam turbine generator system in the Proposed Action, there would be no 'tripping'[8] steam releases either during the start-up phase or during ongoing operations of Sub-alternative A1.

[8] A 'trip' is the shut-down of a system due to an undesirable configuration or condition.

4.9.5.2 OPERATIONS

Sub-alternative A1 would have one large solar field with 150 sub-units, each with its own power inverter. The major components of Sub-alternative A1 would include the following:

- Electrical switchyard/operations and maintenance building with the main step-up transformer and auxiliary transformers
- Solar field with panel trackers and power inverters
- Water well pumping systems

The pertinent noise sources from these components were used in the predictive noise modeling analysis following the methodology discussed above in Section 4.9.1. The predictive modeling results for future noise levels as a result of implementation of Sub-alternative A1 are shown in Table 4.57. Receptor locations are shown on Map 15.

After completion of construction, future Sub-alternative A1 noise levels would reflect the operations of a typical PV-based power-generation facility. The only notable noise sources from Sub-alternative A1 would be electrical transformers, which would only be operating during daylight hours. Because electricity generation from a PV system stops after the sun has set, operational noise levels at night would not be above 16 dBA and would not be audible at any of the noise receptors (Table 4.57).

Table 4.57 Predicted Operations Noise Levels Compared to Ambient Noise Levels – Sub-alternative A1

Receptor Site Type and Name		Noise Levels	Noise Levels (dBA)
Institutional	ST-1	Ambient	63
		Operations	7
Residential	ST-2	Ambient	34
		Operations	15
	LT-2	Ambient	46
		Operations	14
	LT-1	Ambient	48
		Operations	16
Recreational	ST-3	Ambient	28
		Operations	2
	LT-3	Ambient	40
		Operations	13
	RBWA	Ambient	No data
		Operations	3
	BHRP	Ambient	No data
		Operations	9

Source: Mantee (2011).
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).

There are no large rotating equipment items at a PV plant; therefore, there is no likelihood of Sub-alternative A1 generating discernable vibrational energy. Likewise, an insignificant amount of noise and vibration is anticipated from the PV panel tracking systems as these systems gradually rotate the panel arrays during the day.

Sub-alternative A1 would require approximately 16 full-time employees. As with the construction phase, operations traffic is expected to access the site from the west, via SR-85. Given the distance (1–3 miles or more) to the nearest noise receptors, operations traffic would not result in an increase in ambient noise levels at noise receptors.

4.9.6 Alternative B: Reduced Footprint

4.9.6.1 CONSTRUCTION

Changes in ambient noise levels from construction activities associated with Alternative B would be similar to those described for the Proposed Action, but would occur over a 37-month period. Additionally, there would be fewer employees and fewer daily vehicle trips to the SSEP. Peak daily vehicle trips to the SSEP under Alternative B (deliveries and commuters) would be approximately 950 trips per day. The average daily construction travel to the site would be approximately 600 trips per day. Increased ambient noise levels from employee traffic and haul trucks would be similar to that described under the Proposed Action, but would occur over a shorter duration.

The residence at ST-2 is approximately 1,650 feet from the boundary of the Project Area. As a result of the reduced footprint in this alternative, construction activities associated with the solar arrays would occur further from residential areas represented by ST-2. The increased distance between noise receptors and solar field construction activities can be expected to result in reduced audible construction noise at nearby residences, as compared to the Proposed Action construction scenario. Alternative B construction activities may still be audible at receptor locations such as ST-2 during periods of heavy activity, but these construction noise levels would be short term and would dissipate as the activities move farther away from the residences.

4.9.6.2 OPERATIONS

Because operations noise levels are primarily controlled by the power block equipment and not the solar field equipment, changes in the size of the solar field for this alternative would not change the SSEP noise environment relative to the Proposed Action.

4.9.7 Reduced Water Use Option–Brine Concentrator

4.9.7.1 CONSTRUCTION

The brine concentrator would be located in the power block site of the Proposed Action and Alternative B. The application of a brine concentrator option would not change the noise-related impacts of constructing under either the Proposed Action or Alternative B.

4.9.7.2 OPERATIONS

The application of a brine concentrator option would not change the noise-related impacts of operating under either the Proposed Action or Alternative B.

4.9.8 Generation Tie Line Option

4.9.8.1 CONSTRUCTION

If the Gen-tie Line Option were selected in combination with any action alternative, there would be no change to construction activities, methods, or timing. Because construction activities would remain the same, there would be no change in noise emissions with the selection of this option.

4.9.8.2 OPERATIONS

There would be no change to operational noise levels from the selection of the Gen-tie Line Option in combination with any of the action alternatives, because this option would not generate any new or additional sound above the overall operational noise of the entire SSEP facility.

4.9.9 Potential Mitigation Measures

No potential mitigation measures are recommended.

4.9.10 Residual Impacts

There would be no potential mitigation measures for noise; therefore, impacts are described under each alternative.

4.9.11 Short-term Uses versus Long-term Productivity

Construction of the SSEP would result in an increase in ambient noise levels at noise receptors surrounding the Project Area from construction activities occurring in the short term over the 39-month construction phase. Operation of the SSEP would result in long-term, intermittent increases in daytime ambient noise levels of 7–8 dBA at noise-sensitive receptors located in the Goodyear Planning Area, east of the Project Area. This change in the current sound environment would continue during the lifetime of the SSEP.

4.9.12 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible impacts on the sound environment of the area because the plant has a design life and would be decommissioned after 30 years. There would be, however, irretrievable impacts associated with the operation of the SSEP. The increase in ambient noise levels of 7–8 dBA that would result at ST-2 would be an irretrievable loss of the existing sound environment until the SSEP operation is closed and reclamation activities have been completed.

4.10 Paleontology

4.10.1 Analysis Area and Analysis Assumptions

The analysis area for paleontological resources lies in the Project Area boundary, because surface-disturbing activities that could affect fossils are limited to the Project Area. The analysis assumes that the BLM's PFYC system is an appropriate tool to assess the presence of paleontological potential in the Project Area.

4.10.2 No Action

Under the No Action alternative the SSEP would not be built and existing land uses would continue. Livestock grazing and dispersed recreation would not be expected to impact paleontological resources as no fossil sites are known to exist in the Project Area, and the potential for fossils is low (PFYC 2).

4.10.3 Common to All Action Alternatives and Options

As stated in Section 3.10.2, the entire Project Area has a PFYC of 2. This rating suggests that the geologic unit is not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. A PFYC 2 does not require construction monitoring due to the low probability of encountering fossils. The low potential rating within the Project Area suggests that the presence of paleontological resources is unlikely. As such, there would be no anticipated short or long-term adverse impacts to paleontological resources associated with construction and operation of the SSEP.

4.10.4 Potential Mitigation Measures

Construction workers responsible for surface-disturbing activities could be instructed to recognize paleontological resources and the protocol to enact upon discovery during vegetation clearing, site leveling, trenching, excavation of foundations and other surface-disturbing action.

Additionally, any discoveries would be treated in accordance with federal policy implementing the Paleontological Resources Protection Act of 2009. If paleontological resources are discovered inadvertently during construction or operation, the BLM would require the issuance of a paleontological resource use permit to a qualified paleontologist for the scientific collection and study of any vertebrate fossils or occurrences of noteworthy invertebrate or plant fossils.

4.10.5 Residual Impacts

Residual impacts resulting from potential mitigation measures would be beneficial as the specialized training of the construction workforce would result in recognition and protection of fossils, should they be discovered during surface-disturbing construction activities.

4.10.6 Short-term Uses versus Long-term Productivity

The SSEP would not result in adverse impacts to the long-term productivity of the paleontological resources because the geologic formations within the SSEP footprint are not likely to contain paleontological resources.

4.10.7 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of paleontological resources as the presence of such resources within the Project Area is unlikely.

4.11 Recreation and Wilderness Characteristics

4.11.1 Analysis Area and Analysis Assumptions

This section discusses impacts to recreation and wilderness characteristics from the construction and operation of the SSEP. Impacts to recreation will be determined by changes to the type of recreational activities, the settings needed to support those activities, and desired recreational experience, brought on by the implementation of the Proposed Action and the alternatives. Impacts to the areas with wilderness characteristics will be determined by changes to the size and naturalness of each area, and changes to the opportunities for solitude and/or primitive recreation provided by these areas.

As explained in Chapter 3, the analysis area is any topographic point located in the adjacent recreation areas and in areas with wilderness characteristics where sights or sounds from the Project Area would be experienced by the visitor. To assess changes to recreation opportunities resulting from the implementation of the SSEP, this analysis uses information from the Noise and Visual Resources sections of this chapter.

The analysis considers the projected increase in sound at select noise receptors within and surrounding the recreation areas. Given the wide variation in individual thresholds of annoyance, habituation to noise, and situational reactions to noisy environments, there is no common standard for assessing the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. One way of assessing a person's subjective reaction to a new noise is to compare it to the existing or ambient environment familiar to that person. An increase of 1–2 dBA in sound levels is a nonperceptible change to the human ear. An increase of 3–4 dBA may or may not be distinguishable in an outdoor environment. A 5-dBA increase or greater is a perceptible change and is clearly discernible in an outdoor environment (ASHRAE 1989). This analysis assumes that a certain portion of visitors to recreational and wilderness areas are seeking opportunities for quiet and that any noise level increase of 5 dBA or greater would perceptibly diminish one's experience of quietness. It should be noted that 40 dBA gives the subjective impression of "quiet" (Beranek 1988).

Visual simulations used in conjunction with the visual resource contrast analysis are used to estimate changes to the viewshed from select KOPs throughout the analysis area. It is assumed that the greater the degree of contrast, the more visible the SSEP would be on the landscape, and the greater the effect to the recreational activities, settings, and experiences. Based on the definition of existing landscape character (see Section 3.1.1 [General Setting of Project Area]), the visual elements associated with the construction and operation of the SSEP facilities where compared to existing landscape character result in a measure of visual contrast ranging from strong to weak. Measures of visual contrast are defined as follows:

- Strong: visual change demands attention and strongly dominates the landscape.
- Strong/moderate: visual change begins to demand attention and is still moderately dominant in the landscape.
- Moderate: visual change attracts attention but is co-dominant in the landscape.
- Moderate/weak: visual change begins to attract attention and is moderately subordinate in the landscape.
- Weak: visual change can be seen but is subordinate in the landscape.

See Sections 4.9 (Noise) and 4.17 (Visual Resource) for more detailed information on visual resources and noise analysis methodologies and results.

An area in the northwest corner of Sonoran Desert National Monument, north of Margie's Peak, has been submitted to BLM for consideration of its wilderness characteristics in the current RMP revision. Management of the area is being analyzed under alternatives in the draft RMP, and has yet to be decided. The BLM has independently confirmed that this area has wilderness characteristics, as defined in the Wilderness Act of 1964 (Public Law [P.L.] 88-577 (BLM 2011). However, the Project Area does not possess wilderness characteristics. BLM lands of sufficient size to meet the wilderness characteristics size criteria are not present due to roads that cross the BLM lands in and surrounding the Project Area.

Further, this analysis assumes that direct impacts would not occur in the area with wilderness characteristics, the Sonoran Desert National Monument, the North Maricopa Mountains or Sierra Estrella wilderness areas, or the Buckeye Hills Regional Park because they are all located outside of the Project Area footprint where physical disturbances to the character of the landscape and recreation opportunities would occur. However, the indirect effects of the presence (sight) of the construction and operation of the SSEP would degrade the desired recreation activity, setting, and experience in each recreation area, wilderness, area with wilderness characteristics, or the national monument in varying degrees, depending on recreation activity, distance, topography, and preferences of individual visitors. Specific potential indirect impacts to these areas are discussed further in Sections 4.11.3, 4.11.4, 4.11.5, and 4.11.6.

4.11.2 No Action

Under the No Action alternative, the SSEP would not be constructed or operated, and existing recreational uses would continue in the Project Area and adjacent wilderness, lands with wilderness characteristics, national monument, and recreation areas. The landscape and existing roads and trails within the Project Area would not be altered, and there would be no changes to the scene or levels of noise. Therefore, the existing recreation activities, settings, and experiences would remain the same (no change from current conditions) under this alternative.

4.11.3 Proposed Action

Under the Proposed Action, approximately 3,500 acres would be graded to accommodate the project components and fenced for safety and security purposes. This would reduce the size of the ERMA by less than 1% and also reduce the total number of acres managed in the semiprimitive motorized ROS category by less than 1%. This would result in a direct loss of recreational opportunities in the Project Area, including backcountry driving, hiking, hunting, mountain biking, and horseback riding. These activities would be replaced by the single use of renewable energy production with restricted access. Recreational use of the land in the Project Area during the life of the SSEP would be precluded.

The removal of vegetation and construction of the SSEP in the Project Area would have an indirect impact on adjacent recreational users in the analysis area by altering the quality of the recreational setting. Although the sight of a large-scale solar-power facility may attract some recreational users (sightseers), those seeking the features of a primitive or semiprimitive, motorized setting in the Project Area would see the existing landscape change to an area characterized by industrial development and substantial modification of the landscape.

Opportunities for dispersed recreation in the adjacent analysis area would be interrupted during construction of the SSEP due to changes in patterns of access caused by construction traffic. Increases in vehicular traffic on the roads and along utility corridors would deter or delay some recreationists from the area due to safety concerns, noise, and traffic congestion. Conversely, the new road from SR-85 to the SSEP area would provide additional access to public lands for both motorized and nonmotorized recreation activities.

Eight noise receptor locations are identified in Section 4.9 (Noise); six of these are near or within the recreation areas or areas with wilderness characteristics (see Map 15): 1) ST-1 located approximately 3 miles south of the Buckeye Hills Regional Park; 2) ST-3 located in the northern portion of the Northern Maricopa Mountains Wilderness; 3) LT-2 located approximately 10 miles west of the Sierra Estrella Wilderness; 4) LT-3 located in the northern portion of the Sonoran Desert National Monument and 340 feet from the area with wilderness characteristics; 5) Buckeye Hills Regional Park located approximately 6 miles west-northwest of the Project Area and; 6) Robbins Butte Wildlife Area. All noise from operation and construction would dissipate within approximately 1.75 miles of the source[9] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions. Table 4.58 summarizes the existing baseline noise levels and the anticipated construction and operation noise levels at these receptors.

Based on the information in Table 4.58, ambient noise levels would increase by 5–12 dBA at recreational noise receptors during the 39-month construction period. The increases in noise levels could affect the recreational experience for some visitors in the North Maricopa Mountains Wilderness and the Sonoran Desert National Monument. Noise levels would be no more than 44 dBA. As visitors venture deeper into the recreation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect of this increase in noise on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Noise levels would not be above ambient sound levels during operations; therefore, there would be no effect on the recreational experience in North Maricopa Mountains Wilderness and the Sonoran Desert National Monument after the construction period.

Because there are no ambient noise level data for Buckeye Hills Regional Park and Robbins Butte Wildlife Area, this analysis cannot determine if there would be increases in the ambient environment noise levels. However, construction noise levels would not be above 39 dBA; therefore, it is unlikely that there would be impacts to the recreational experience except for highly sensitive individuals. Operational noise levels would not be above ambient sound levels at the monitoring locations; therefore, there would be no effects on the recreational experience in Buckeye Hills Regional Park and Robbins Butte Wildlife Area.

Table 4.58 Ambient, Construction, and Operational Noise Levels at Select Noise Receptors

Name/Location of Receptor	Ambient Noise Levels	Construction Noise Levels	Operational Noise Levels
ST-1/Prison/Frontage Road	62.7	38	16
ST-3/NMMW	28.2	40	21
LT-2/Hayes Road	46.4	43	26
LT-3/SDNM	39.7	44	27
BHRP	No ambient data	39	19
RBWA	No ambient data	37	11

Notes:
Only the six noise-monitoring stations that are relevant to recreation and wilderness are included in this table.
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).

[9] Noise attenuation to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA).

The Project Area would be visible to recreationists in all of the recreation areas and the area with wilderness characteristics, except for the Buckeye Hills Regional Park, which would be completely screened from the SSEP when viewed at lower elevations. At higher elevations, recreation users could have superior or unobstructed views of the entire SSEP. When looking south from areas north of the Project Area (such as Highway 85), vertical structures associated with the project could be visible against the backdrop of the Sonoran Desert National Monument to the southeast. Due to the superior views from the Sonoran Desert National Monument (KOPs 2 and 6, see Section 4.17 for further details), high-sensitivity viewers would experience adverse impacts from the strong contrast presented by the project facility. From the North Maricopa Mountains Wilderness (KOP 1, see Section 4.17 for further details) and the area with wilderness characteristics, a viewer would expect a moderate contrast, meaning the contrast begins to attract attention and begins to dominate the landscape. However, there would be some topographic screening of the project facility. The entire Project Area would be visible from the Sierra Estrella Wilderness (KOP 18, see Section 4.17 for further details) and would have a moderate contrast rating; however, at a distance of 10 miles from the Project Area, the project would be viewed in the context of existing regional modifications. The presence of the SSEP in the viewshed in these areas would diminish the recreational experience, depending on the individual visitor's desired recreation experience and tolerance to the presence of the SSEP. See the Recreation Areas section of Section 4.17 (Visual Resources) for details on visual resource impacts.

4.11.3.1 WILDERNESS CHARACTERISTICS

The size of the area with wilderness characteristics would not be affected because the unit is outside of the Project Area and it would not be affected by any surface disturbance resulting from construction of the SSEP. For the same reason, there would be no impacts to naturalness because no component of the project would be constructed in the area with wilderness characteristics. However, opportunities for primitive and unconfined recreation would be adversely impacted in some locations (KOP 6, see Section 4.17 for further details) for sensitive viewers (such as photographers) by the sights from construction and operation of the SSEP. As described in the Recreation analysis above, the experience (solitude, isolation) and the undisturbed setting needed to support recreation activities like hiking, camping, and other primitive outdoor activities in the area with wilderness characteristics would be diminished for sensitive users (such as photographers) by the presence (sight) of the SSEP for some distance into the area. As visitors venture deeper into the core of the area, the view and its effects on the desired setting and experience would lessen and eventually disappear. See the recreational experience discussion above for a detailed description of the impacts from the sights of the SSEP. The impacts to the solitude and primitive recreation for the area with wilderness characteristics would be the same.

4.11.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts to recreation and wilderness characteristics under Alternative A would be the same as the Proposed Action because the number of acres of surface disturbance for the project footprint would remain the same as under the Proposed Action. The components of a dry-cooled facility are similar to the Proposed Action, as are construction methods. Further, there would be no change in the number of vehicles used for construction and operation or any differences in access between the two alternatives.

4.11.5 Sub-alternative A1: Photovoltaic

Impacts to recreation and wilderness characteristics under Sub-alternative A1 would be less than under the Proposed Action because of the sub-alternative's smaller project footprint. The number of acres of surface disturbance for the project footprint would be approximately 2,013 acres, which is 44% less than under the Proposed Action.

The components of the facility and the construction phases under Sub-alternative A1 differ from the Proposed Action. Construction under Sub-alternative A1 would take the same amount of time as under the Proposed Action but would be staged in a 100-MW-per-year manner.

The number of vehicle trips during peak construction and regular operations would be reduced by 733 trips (73%); however, there would be no differences in access roads and transportation corridors between Sub-alternative A1 and the Proposed Action.

Noise from construction of the SSEP under this sub-alternative would be roughly comparable to the predictions for the Proposed Action. For the Proposed Action, there are instances of noise levels in the low to mid-40s dBA for construction. Under Sub-alternative A1, noise levels would not exceed 46 dBA. As visitors venture deeper into the recreation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Operational noise levels under this alternative would not exceed ambient conditions; therefore, there would be no effects to the recreational experience during operations.

4.11.6 Alternative B: Reduced Footprint

Alternative B, like the Proposed Action, is a wet-cooled solar-powered electricity-generating facility, but occupies a smaller footprint (2,300 acres). The nature of impacts under Alternative B, to recreation opportunities in the Project Area and to recreation opportunities and wilderness characteristics adjacent to the Project Area, would be the same as under the Proposed Action, because the construction and operation of the SSEP would be executed in the same manner. However, under this alternative, only 2,300 acres within the ERMA, and managed for semiprimitive motorized recreation opportunities, would be converted to a solar-powered electricity-generating facility. This represents a 34% decrease in the Project Area footprint as compared to the Proposed Action.

4.11.7 Reduced Water Use Option–Brine Concentrator

The Reduced Water Use Option would not affect recreation and wilderness characteristics outside of those impacts already discussed under the Proposed Action and Alternative B. This is because the number of acres of surface disturbance for the Project Area footprint would remain the same under each action alternative, irrespective of the installation and use of a brine concentrator. Further, there would be no change in the number of vehicles used for construction and operation, nor would there be any differences in access if a brine concentrator were employed.

4.11.8 Generation Tie Line Option

The Gen-tie Line Option would not have direct impacts in recreation areas or the areas with wilderness characteristics because they are all located outside of the Project Area where physical disturbances to the character of the landscape and recreation opportunities would occur. As with the proposed gen-tie line, indirect impacts from the Gen-tie Line Option would include the presence (sight) of the line, which would degrade the desired recreation activity, setting, and experience. The Gen-tie Line Option would not impact noise levels from the construction and operation of the SSEP because it would not generate any new or additional sound.

If the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land (Table 4.59) when compared to the total acres of disturbance of these alternatives in combination with the proposed gen-tie line. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative

A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Additional acres of surface disturbance under the Gen-tie Line Option are outlined in Table 4.59.

Table 4.59 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.11.9 Potential Mitigation Measures

Potential mitigation measures for visual impacts are described in Section 4.17.8.

The following mitigation measures could be implemented to maintain worker and visitor safety during construction of the SSEP and to provide continued recreational access to public lands:

- Use of traffic control measures (such as passive control and/or personnel) would reduce the risk of vehicle accidents and congestion and ensure continued access to adjacent public and private lands during construction of the SSEP.
- Maintenance of access roads would ensure continued availability of public lands for recreation uses.

4.11.10 Residual Impacts

Use of traffic control personnel would minimize but not completely prevent the risk of vehicle accidents and congestion during construction of the SSEP. Accidents or traffic congestion may still occur.

4.11.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would result in use of land and other resources for renewable energy rather than recreation. Implementation of the project would eliminate recreational access and activities in the Project Area for the life of the SSEP (30 years). Specifically there would be long-term changes in hunting, hiking, and motorized vehicle use patterns because construction of the SSEP would limit access to the Project Area. Implementation of the SSEP would create long-term disruptions of the visual quality because of the soil and vegetation disturbances and changes of the land use to an industrial setting, affecting the availability of adjacent lands for recreational purposes. There would be no maintenance or enhancement of recreational resources, thereby precluding any long-term use of the Project Area for recreation during the lifetime of the project.

4.11.12 Irreversible and Irretrievable Commitments of Resources

The reclamation measures outlined in Chapter 2 require reclamation of the disturbed areas after the 30-year life of the project. Site reclamation would require completion of a decommissioning and site reclamation plan to define the specific reclamation, revegetation, restoration, and soil stabilization requirements for the Project Area. Details of the reclamation requirements are discussed in Chapter 2.

Because the Project Area would be reclaimed, there would be no irreversible loss of recreation opportunities associated with the Proposed Action or other alternatives. However, it could take years before the project footprint is no longer visible. Even when vegetation is established during reclamation efforts the composition of plant species in the recovery area is often different than the original vegetation community. Typically, grasses establish early on, whereas shrubs take much longer to reestablish. The project footprint could visibly persist for years beyond reclamation. This would be an irretrievable change to the recreation setting and could result in displacement of recreation users or alteration of their experiences or activities.

There would also be irretrievable impacts to recreation and areas with wilderness characteristics because construction and operation of the SSEP would alter the adjacent scenery to a more industrial setting, as viewed from within the adjacent recreation areas and/or area with wilderness characteristics. As described above, the existing landscape setting would be restored upon reclamation. Thus, the effects on recreation opportunities and wilderness characteristics are not irreversible.

4.12 Socioeconomics

4.12.1 Analysis Area and Analysis Assumptions

The impacts analysis for socioeconomics evaluates how the social and economic effects, both positive and negative, of the construction and operations phases of the SSEP would be distributed among the communities in the SESA. The analysis considers impacts to Maricopa and Pinal counties with specific detail given to communities closest to the SSEP site.

This section contains an analysis of the potential socioeconomic impacts associated with the two phases of the proposed SSEP: construction and operation. Short-term impacts are considered to be five years or less (generally, the construction phase). Long-term impacts are considered to be greater than five years for the life of the project (the operations phase).

The social and economic impacts are quantified where possible. However, where quantification of impacts is not possible, the analysis includes a qualitative discussion of possible effects. The analysis includes separate but integrated approaches to addressing social, economic, fiscal, and EJ impacts of the SSEP.

It is assumed that the Brine Concentrator and Gen-tie Line options would not contribute to additional social or economic impacts under the action alternatives because the workforce, duration, and maximum MWh output would be the same as the action alternatives without the implementation of these options. Therefore, the Brine Concentrator and Gen-tie Line options will not be discussed further in the socioeconomic analysis.

4.12.2 Social Impacts

4.12.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be built, and impacts to local social conditions would remain similar to current conditions. The area would maintain the undeveloped, rural character that contributes to the overall sense of place for those living near the area.

4.12.2.2 PROPOSED ACTION

4.12.2.2.1 Project Workforce and Skills

Construction

Project construction would occur over a total of 39 months on a phased schedule. Construction would begin in December 2011 starting with the 125-MW unit. Construction of the 250-MW unit would follow such that the total 375-MW facility would be complete by the summer of 2014. All associated linear facilities would be constructed concurrently with the power-generation units.

SSEP construction operations, including linear facility construction, would require an average of 874 full-time skilled and unskilled employees per month over the entire 39-month construction period, with manpower requirements peaking at approximately 1,538 workers in month 24 of construction (Table 4.60. The peak of employment may vary slightly depending on the exact overlapping of the phased development and construction of the two units.

The primary trades required for construction of the SSEP include carpenters, electricians, insulators, ironworkers, cement masons, mill wrights, operating engineers, painters, pipefitters, and skilled and unskilled laborers. Solar field craft workers are primarily laborers and equipment operators who would be directly associated with the installation and assembly of the solar field. Construction employees would be expected to work 22 days per month, approximately 10 hours per day. It is expected that approximately 10% of the construction workforce would require specialty skills that could not be filled by the local workforce. These workers would either relocate temporarily or move to the area permanently. Construction payroll is estimated to be approximately $215 million over the life of the construction phase of this project (personal communication, Jared Foster 2009).

Table 4.60 Construction Workforce by Month

Month of Construction	Carpenter	Electrician	Insulators	Ironworker (civil and structural)	Laborers (civil, concrete, structural, electrical, and mechanical)	Cement Masons	Millwrights	Operating Engineers (civil, concrete, structural, electrical, and mechanical)	Painters	Pipefitters	Teamsters (civil, concrete, structural, electrical, and mechanical)	Total Power Block Craft	Solar Field Craft	Total Craft	Construction Staff	Construction Management Staff (NextEra)	Subcontractors	Technical Advisors	Total Staff	Total Craft and Staff
1	4	6	0	3	14	0	0	30	0	0	9	**66**	0	**66**	28	10	6	0	**44**	**110**
2	8	10	0	6	18	0	0	30	0	0	9	**81**	0	**81**	38	10	6	0	**54**	**135**
3	8	10	0	6	32	0	0	42	0	10	18	**126**	0	**126**	40	10	6	0	**56**	**182**
4	8	35	0	6	36	0	0	35	0	20	17	**157**	33	**190**	40	10	6	0	**56**	**246**
5	8	35	0	12	38	0	0	35	0	40	17	**185**	60	**245**	40	10	6	0	**56**	**301**
6	13	40	0	26	44	4	0	38	0	70	17	**252**	106	**358**	40	10	6	0	**56**	**414**
7	23	53	0	29	65	4	0	75	0	100	28	**377**	150	**527**	94	23	10	0	**127**	**654**
8	23	68	0	40	74	4	0	77	0	100	28	**414**	200	**614**	94	23	9	2	**128**	**742**
9	29	93	0	48	87	6	3	77	0	133	30	**506**	225	**731**	94	23	9	4	**130**	**861**
10	35	85	0	48	85	6	3	75	0	157	41	**535**	240	**775**	94	23	8	4	**129**	**904**
11	43	95	0	61	87	4	3	75	0	174	41	**583**	420	**1,003**	94	23	8	4	**129**	**1,132**
12	44	95	0	64	91	4	16	76	0	176	41	**607**	420	**1,027**	94	23	8	4	**129**	**1,156**
13	50	95	0	71	93	4	16	76	0	176	41	**622**	420	**1,042**	94	23	8	4	**129**	**1,171**
14	58	97	0	82	94	4	16	76	0	176	45	**648**	420	**1,068**	94	23	8	4	**129**	**1,197**
15	59	97	0	88	110	4	16	91	0	188	45	**698**	420	**1,118**	94	23	8	4	**129**	**1,247**
16	59	95	0	92	115	4	16	89	0	192	43	**705**	154	**859**	110	23	8	4	**145**	**1,004**
17	49	102	0	92	115	4	16	83	0	199	45	**705**	154	**859**	130	23	14	4	**171**	**1,030**
18	40	89	8	86	115	9	14	83	0	199	45	**688**	154	**842**	130	23	14	6	**173**	**1,015**
19	40	101	8	84	110	9	14	75	0	202	41	**684**	353	**1,037**	138	23	14	6	**181**	**1,218**
20	36	97	16	77	98	9	14	65	5	223	39	**679**	382	**1061**	147	23	14	9	**193**	**1,254**

Table 4.60 Construction Workforce by Month

Month of Construction	Carpenter	Electrician	Insulators	Ironworker (civil and structural)	Laborers (civil, concrete, structural, electrical, and mechanical)	Cement Masons	Millwrights	Operating Engineers (civil, concrete, structural, electrical, and mechanical)	Painters	Pipefitters	Teamsters (civil, concrete, structural, electrical, and mechanical)	**Total Power Block Craft**	Solar Field Craft	**Total Craft**	Construction Staff	Construction Management Staff (NextEra)	Subcontractors	Technical Advisors	**Total Staff**	**Total Craft and Staff**
21	42	124	24	72	98	8	22	59	8	232	39	**728**	464	**1192**	147	23	14	13	**197**	**1389**
22	40	128	24	67	98	8	22	59	12	222	39	**719**	553	**1272**	152	23	10	13	**198**	**1470**
23	48	130	24	73	96	5	22	59	15	202	27	**701**	587	**1288**	152	23	10	15	**200**	**1488**
24	57	129	24	79	101	5	28	59	15	218	33	**748**	587	**1335**	157	23	10	13	**203**	**1538**
25	64	129	12	82	101	5	28	57	10	178	46	**712**	553	**1265**	137	23	10	13	**183**	**1448**
26	66	105	0	81	89	5	20	37	0	158	39	**600**	487	**1087**	77	13	6	7	**103**	**1190**
27	66	105	0	93	91	5	20	37	0	171	39	**627**	487	**1114**	77	13	6	7	**103**	**1217**
28	66	99	0	97	94	5	20	37	0	171	36	**625**	97	**722**	104	13	7	7	**131**	**853**
29	53	99	0	94	94	5	20	37	0	180	38	**620**	97	**717**	139	13	7	7	**166**	**883**
30	39	78	11	86	88	5	19	37	0	180	38	**581**	97	**678**	139	13	7	10	**169**	**847**
31	31	78	11	80	85	5	19	44	0	180	33	**566**	97	**663**	139	13	7	10	**169**	**832**
32	16	60	20	63	61	5	19	36	6	171	31	**488**	97	**585**	139	17	7	10	**173**	**758**
33	16	60	31	56	61	0	25	30	11	132	31	**453**	97	**550**	139	17	7	10	**173**	**723**
34	11	46	31	41	49	0	25	30	16	118	31	**398**	97	**495**	139	17	7	10	**173**	**668**
35	11	33	31	33	44	0	25	30	20	93	16	**336**	146	**482**	139	17	7	14	**177**	**659**
36	11	31	31	28	36	0	11	30	20	78	14	**290**	146	**436**	139	17	7	10	**173**	**609**
37	11	31	27	0	36	0	11	30	20	66	14	**246**	146	**392**	139	17	7	10	**173**	**565**
38	11	31	20	0	36	0	11	30	13	53	14	**219**	146	**365**	139	17	7	10	**173**	**538**
39	11	31	16	16	36	0	11	27	13	27	14	**202**	97	**299**	104	17	7	10	**138**	**437**

The staffing for the construction phase of the SSEP would be expected to draw from the existing construction workforce in the region, including the Phoenix metropolitan statistical area (MSA). The construction industry in the Phoenix MSA has been particularly affected by the nation's recent economic downturn and the weak housing market in the region (Arizona Department of Commerce 2009c). As a result, a plentiful workforce is available in this region to accommodate the construction needs of the SSEP. For example, construction employment in the Phoenix MSA is projected to fall 23% between 2008 and 2010, from 140,700 to 108,200; a loss of approximately 32,500 jobs (Arizona Department of Commerce 2009c). Table 4.61 summarizes these figures for the construction industry. Similarly, the Phoenix MSA unemployment rate has risen from 4.9% in 2008 to 7.4% in 2009, indicating that a considerable workforce is seeking jobs in the region (Arizona Department of Commerce 2009e).

Table 4.61 Construction Industry Employment

Area	2006	2007	2008	2009 Forecast	2010 Forecast	Percentage Change 2006 to 2010 (or 2009 if 2010 is not available)
Arizona	240,300	224,900	187,800	147,500	144,600	-39.8%
Annual percentage change	–	-6.4%	-16.5%	-21.4%	-2.0%	–
Phoenix MSA	180,100	169,400	140,700	110,500	108,200	-39.9%
Annual percentage change	–	-5.9%	-16.9%	-30.2%	-2.3%	–
Maricopa County*	179,200	168,400	140,000	106,100	n/a	-40.8
Annual percentage change	–	-6.0%	-32.3%	-24.2%	n/a	–
Pinal County*	3,650	4,225	4,450	3,850	n/a	5.5%
Annual percentage change	–	15.7%	5.3%	-15.4%	n/a	–

Source: Arizona Department of Commerce (2009c, 2009d).
* Includes both construction and mining employment.

In summary, in 2008 there were 187,800 construction jobs in the state and 140,700 construction jobs in the Phoenix MSA, or 75% of the state's construction jobs. In 2007 Maricopa County accounted for 98% of construction employment within the two-county MSA region (U.S. Bureau of Economic Analysis 2009). Therefore, of the state's construction job losses, over 70% are occurring in Maricopa County.

The construction workforce for SSEP would be expected to be filled by the available labor supply in Maricopa County and the Phoenix MSA. As stated above, the SSEP would require an average annual workforce of 874 and peak workforce of 1,538. Construction employment resulting from the development of the SSEP would be a beneficial short-term impact to individuals in nearby communities seeking employment, because the project would provide new construction jobs to an area that has recently endured high rates of unemployment.

Operations

The operations workforce would consist of approximately 80 full-time employees for the entire facility. These employees would consist of plant operators and maintenance technicians working on 12-hour shifts and administrative personnel working on eight-hour shifts. The facility would be staffed seven days a week, 24 hours a day, 365 days a year, although the hours of the plant operations would be from sunrise to sunset.

Total full-time annual payroll would be expected to be $8.5 million, which would include benefits and incentive pay in addition to salaries (personal communication, Brandon Stankiewicz 2009). A range of wages would be expected among those employed by the SSEP, from lower wages of a general laborer to higher wages of the project management staff and technical advisors. Staffing for the operations of the SSEP would result in beneficial long-term impacts to individuals seeking stable employment, because the SSEP would provide long-term employment and income throughout the life of the project. For detailed information on the direct, indirect, and induced impacts of employment, income, and sales revenue; see Section 4.12.3.

4.12.2.2.2 Population

Construction

As noted previously, it would be anticipated that most (approximately 90%) of the construction workforce (a peak of 1,538 and an average of 874 workers per month over the 39-month construction period) would commute to the SSEP from their residences, rather than relocate. Construction employees typically commute up to two hours from their homes (Electric Power Research Institute 1982). However, approximately 10% of the workforce is expected to require specialty skills and would either relocate to the region temporarily or permanently, including staying in hotels/motels, apartments, or purchasing a home. Thus, population is expected to grow at least temporarily by approximately 87 individuals over the duration of the construction phase. Buckeye and Goodyear, the closest communities to the SSEP would likely receive these residents. This immigration represents 0.2%, 0.3%, and 0.002% of 2005 population levels for Buckeye, Goodyear, and Maricopa County, respectively. These immigration figures are summarized in Table 4.62. Further, because of the considerable loss of construction jobs in surrounding communities as a result of the current economic recession, there is a significant pool of unemployed skilled construction labor in the region. Consequently, workers hired to construct the SSEP would likely be drawn from the existing workforce, and not from a migratory workforce from outside the Phoenix MSA. As a result, the construction phase of the SSEP would be expected to result in no more than a 0.3% increase in population growth in the Socioeconomic Study Area.

Table 4.62 Population Impacts

Population	Goodyear	Buckeye	Maricopa County
Population (2005)	47,520	32,735	3,646,569
Projected population (2010)	71,354	74,906	4,216,499
Relocating construction workforce	87	87	87
Percent of relocated population (2005)	0.2%	0.3%	0.002%
Percent of relocated population (2010)	0.1%	0.1%	0.002%

Source: Maricopa Association of Governments (MAG) (2007b).

Operations

There would be approximately 5 to 10 project operators with specialized technical skills for this type of solar facility that would be expected to relocate to the area to provide long-term expertise in operations and maintenance. The remainder of the operations workforce would come from local residents. The immigration of 5 to 10 workers to the area for the operations phase of the SSEP would result in less than a 0.1% increase in population in the SESA.

4.12.2.2.3 Housing

Construction

Because 90% of the construction workforce would be expected to commute to SSEP rather than relocate, increased demands on the local housing supply would be expected to be nonexistent. Research indicates that construction workers are willing to commute up to two hours one-way for a job (an average of 73 miles and maximum of 115 miles one-way) (Electric Power Research Institute 1982). As a result, most of the workers would be coming from the City of Phoenix and its suburbs, located approximately 40 miles northeast of the Project Area. Little or no transient housing would be required in the Project Area or in the communities closest to the Project Area.

In addition, because of the availability of hotel and motel accommodations and the fairly consistent housing vacancy rates in nearby communities, workers who choose to relocate temporarily (estimated to be 10% of the workforce) would not be expected to affect housing availability (result in a housing shortage). Housing vacancy rates in 2007 were over 10% in Pinal and Maricopa counties, with over 2,500 available housing units in the communities of Buckeye and Goodyear alone. Additionally, the communities of Buckeye, Goodyear, and Gila Bend have approximately 40 hotels and motels available, with hundreds more hotels in Phoenix and its suburbs. SSEP construction activities would not be expected to affect housing vacancy rates, housing prices, or rental costs.

Operations

The operation of the SSEP would have very little impact on the availability of housing, because the number of workers needed for the operation of the plant is relatively small (80), and because of the large number of vacant housing units in the surrounding communities. Buckeye and Goodyear alone had over 2,500 available housing units in 2007. The SSEP would be constructed in a rural area on BLM land and would not physically alter any existing residential or commercial communities. However, there are approximately 15 parcels of private property, with at least one residential structure per parcel, within 1 mile of the eastern boundary of the Project Area.

The long-term operations of a solar facility and associated transmission lines could affect property values in nearby communities. Property values could decline as a result of the change in aesthetic quality, increases in noise, real or perceived health effects, congestion, or disruption of social connections. In contrast, property values have the potential to increase because of the close proximity to employment opportunities associated with the development and operation of the solar facility (BLM and DOE 2010). Because there are a number of private parcels of land close to the eastern border of the Project Area, it is possible that these parcels would be negatively affected by the development and operations of the SSEP. Research indicates that the effect of industrial site presence on housing prices is only experienced within relatively short distances to the site. Houses within 0.15 mile from an industrial site are predicted to sell at 14.9% less than houses located 1.4 miles (study reference point) from an industrial site. Residential properties located greater than 0.6 mile from an industrial site were found to have no discernable effect on property values (de Vor and de Groot 2009). Similar research has been done on impacts to property values associated with transmission lines. Where there would be negative impacts to property values from transmission lines, they would disappear between 200 and 650 feet from the line (Priestley 2005). Impacts on residential property values within these distances vary considerably depending on the location, amenities, housing markets, size of the industrial site, etc. Generally, single family properties have shown 2% to 10% lower values when in very close proximity (within approximately 200 feet) to transmission lines (Priestley 2005).

Although there is no evidence on the impact of solar facilities on local property values, there has been limited research conducted on the impact of nonrenewable energy development on property values. Communities adjacent to oil and gas drilling activities in western Colorado reportedly endured a decline in property values upon announcement of drilling and during the initial stages of extraction. However, property values rebounded, at least partly, once production was underway (BLM and DOE 2010).

Under the Proposed Action, approximately six private parcels of land with residential structures are located less than 0.6 mile of the Project Area, and therefore could have slight reductions in value (up to 14.9%) due to the construction and operation of the SSEP (de Vor and de Groot 2009). However, based on previous research, this slight adverse impact on property values in the immediate vicinity of the solar facility would likely dissipate as long-term operations get underway (BLM and DOE 2010).

Property values do have the potential to increase under conditions of moderate population growth and housing demand. In studies where expansion of the local employment occurred as a result of a new industrial facility operation, a positive impact on property values was found to be associated with an increase in the demand for local housing (BLM and DOE 2010). However, the operation of SSEP would have little impact on housing demand, based on the existing housing vacancy rates and the small amount of workers anticipated to relocate to the area.

4.12.2.2.4 Public Services

Construction

Construction of the SSEP would not result in an increase in demand for public services. Current police, fire, and medical facilities should be sufficient to handle emergencies during construction activities at the site. Construction workers would be expected to obtain health insurance from their employers.

The SSEP would rely on on-site fire protection systems and off-site fire protection services. The SSEP would establish a construction emergency action program and plan that would include emergency evacuation procedures. The SSEP would also develop and implement a PPE program for both construction and operation phases of the project.

The Buckeye Fire Department would be the first responders in the case of fire and medical emergencies during construction of the SSEP. The department has six fire stations, each of which has its own fire truck. The Buckeye Fire Department currently has the capacity to respond to a potential increase in incidents in the Project Area (personal communication, Van Valkenburg 2009). Station 701 is located at 404 South Miller Road in Buckeye, which is approximately 10 miles north of the Project Area. Fire officials estimate that it would take approximately 10 minutes or less for emergency vehicles to arrive at the Project Area to provide services.

In the event of large numbers of incidents (up to one per day in the Project Area), this station would have the ability to provide emergency fire and medical services (personal communication, Van Valkenburg 2009).The Town of Buckeye Police Department would have the capacity to respond to incidents associated with development of the SSEP in the Project Area, with an average response time of five to eight minutes (personal communication, Phil Harris 2009).

Utilities

Construction of the SSEP would require potable water and electrical utility supplies, and would also generate wastewater and solid waste. Potable water for construction activities would be trucked onto the site. All power would be generated on-site for construction; however, if power is available through existing distribution, the construction contractors may elect to use it.

Waste generated during construction would be disposed of at the closest landfill, the Southwest Regional Landfill, located approximately 2 miles west of the Project Area. This landfill is located just southeast of the intersection of SR-85 and Komatke Road. Currently, the landfill charges $26.25 per ton (prorated) of construction debris and has abundant capacity to receive additional debris (personal communication, Kathy Lugo 2009). The City of Phoenix owns another landfill approximately 5 miles southwest of the Project Area, located west of Highway 85 and south of Patterson Road. Sanitary wastes generated during construction would be collected in portable self-contained toilets and hauled to an appropriate disposal site by a servicing contractor.

Schools

Given that 90% of the workforce would come from surrounding communities, SSEP construction would not have an adverse impact on local school systems. The families of the construction workers are already enrolled in the current school system and would not increase or decrease as a result of the project. Additionally, construction workers who relocate temporarily for a work assignment (10%) typically would not bring their families with them. The school closest to the Project Area is approximately 10 miles away, and school activities would not be affected by SSEP construction activities (e.g., traffic, noise, or air emissions).

Operations

Population would not be expected to change as a result of the operations of the facility, and therefore the capacity of the local emergency services should also not change substantially. The services provided by Buckeye Fire Department, Buckeye Valley Fire District, and Buckeye Police Department would not be expected to be affected by the SSEP facility operation.

Utilities

The SSEP would use on-site groundwater and would therefore have no impact on local water utilities. SSEP sanitary wastes would be disposed of by an on-site waste treatment system, with a septic tank and leach field. Operations would have no impact on the availability of local wastewater treatment capacity.

The SSEP would use natural gas for start-up and HTF freeze protection, and may also be used to support a small percentage (up to 25%) of actual power generation. The annual maximum natural gas usage under the Proposed Action would be 3,982,000 MMBtu. The SSEP may also require electrical power for maintenance activities during nighttime hours when the facility is not generating its own power.

Schools

Operation of the SSEP would have no impact on local schools because of the relatively small number of workers needed for operation of the plant (maximum of 80). Additionally, because almost all of the workers are expected to be local residents, their children would already be enrolled in the local schools and no additional enrollment demand would occur.

4.12.2.2.5 Quality of Life Conditions

Construction

As discussed in Section 3.12.2.5, the communities closest to the Project Area, Buckeye and Goodyear, have historical connections to farming and ranching. The rural, moderately developed area has recently begun to feel development pressure as the urban growth from the Phoenix metropolitan area presses south

and west. Recently completed planning documents suggest that the communities are interested in fostering opportunities for economic growth and mixed-use development.

The communities closest to the Project Area would likely notice adverse impacts to their current rural quality of life. During the construction phase, traffic would increase in the communities near the Project Area. At the peak of construction, approximately 1,000 vehicles carrying workers would commute to and from the Project Area on a daily basis, and 30 to 60 trucks per day would make trips to the site. See Section 4.15 for further detail on the transportation and traffic analysis. Noise levels during construction would increase at outdoor residential receptor locations. However, noise increases as a result of construction would be reduced to sound levels generally considered "quiet" if residents near residential receptor sites are indoors (see Section 4.9 for detailed information on noise receptor locations). From a visual perspective, the Proposed Action would change the landscape characteristics, existing landforms, and vegetation in the area, which would contribute to an overall change in the sense of place for members in nearby communities. The shift from a rural, moderately developed landscape to a more industrialized landscape would adversely impact local residents and visitors to the area who are seeking a rural to moderately developed residential community, semiprimitive views, or recreation experience.

Recreation experiences can contribute to a person's overall quality of life and/or shape their identity or self perceptions. Individuals seeking solitude and a primitive recreation experiences would be adversely impacted by the views and noise from the SSEP during construction and operation, as they hear the noise from construction and operations and see the change in landscape. Changes in visual character of the Project Area would be experienced by recreationists in the nearby recreation areas and areas with wilderness characteristics considered for analysis, except for the Buckeye Hills Regional Park (see Section 4.11 for further detail on impacts to recreation). Project-related noise would not likely impact recreationists in recreation and wilderness areas more than 1.75 miles from the Project Area, as stated in Section 4.9. Conversely, new and improved roads and utility corridors surrounding the SSEP would provide for more opportunities for motorized travel, and the Proposed Action would therefore be perceived as a beneficial recreational impact to an OHV user group.

Operations

Although the amount of vehicle traffic and noise would decrease, when compared to the construction phase of the SSEP, the change to the visual landscape would remain for the life of the project. The installation and operation of 3,620 acres of mirrored solar troughs would result in a change in an individuals' identification with the area, as the SSEP would change the existing land use from one they have historically identified with to a more industrialized land use. The long-term operation of the SSEP could lead to a change in the nearby communities' self perception, from identifying with an area that is rural and moderately developed to identifying with a place shaped by industry and renewable energy development.

The industrial nature of the long-term operation may adversely impact those residents and visitors to the area who have previously identified with the area as a moderately developed, rural landscape. Those members of the community who have an adverse reaction to a change in their perceived quality of life may choose to move from the area. People who are seeking to relocate to a rural and moderately developed community, such as Goodyear or Buckeye, may not be attracted to the area and choose to live elsewhere.

4.12.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

The social impacts (population and housing) under Alternative A would be the same as under the Proposed Action because the duration of construction and nonmigratory workforce required to construct and operate the SSEP would be the same as under the Proposed Action. With regard to the delivery and

transmission of public utilities, there would be a decrease in the amount of natural gas required under Alternative A, when compared to the Proposed Action. The annual maximum natural gas usage under Alternative A would be 3,623,620, a 9% decrease in the amount of natural gas required for the SSEP. Groundwater use would be 90% less under Alternative A when compared to the Proposed Action. Quality of life impacts would be the same under Alternative A and the Proposed Action because the change in land use would be the same under both alternatives.

4.12.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.2.4.1 Workforce and skills

Construction

Under Sub-alternative A1, project construction would require 61% less full-time skilled and unskilled employees per month than under the Proposed Action. The average workforce required over the 39-month construction period would be 335, compared to 874 under the Proposed Action. The monthly workforce would peak at 378 under Sub-alternative A1, a 75% reduction in peak workforce when compared to the Proposed Action's peak workforce of 1,538. Payroll over the life of the construction phase would total approximately \$75 million, a 65% reduction in construction payroll when compared to the Proposed Action's total estimated payroll cost of \$215 million.

Operations

Sub-alternative A1 would require 16 full-time employees, an 80% reduction in operations workforce when compared to the Proposed Action. The total full-time annual operations payroll would be \$1.5 million, an 82% reduction in operations payroll when compared to the \$8.5 million annual operations payroll under the Proposed Action.

4.12.2.4.2 Population and Housing

Construction

As under the Proposed Action, it is assumed that 10% of the workforce would relocate to the region temporarily or permanently under Sub-alternative A1. These workers would likely stay in hotel/motels, apartments, or purchase homes. The remainder of the construction workforce would be filled by the local workforce. Thus, the population would be expected to grow by approximately 34 individuals during the construction phase, a 0.1 % or less increase in projected population levels for Buckeye, Goodyear, and Maricopa counties. The population increase under Sub-alternative A1 would be 61 % less than the Proposed Action. Because construction activities under Sub-alternative A1 would have negligible impacts on population growth in the communities surrounding the Project Area, housing vacancy rates, housing prices, or rental costs are not likely to be impacted under Sub-alternative A1.

Operations

As under the Proposed Action, the operations workforce positions under Sub-alternative A1 would be mostly filled by local residents. Approximately three to five project operators with specialized technical skills would be required to relocate to the area to provide expertise in operations and maintenance. Throughout the operations phase, negligible impacts on population growth in local communities surrounding the Project Area are anticipated. Housing impacts would also be negligible under Sub-alternative A1 because the number of relocating workers needed for the operation of the plant would be very small.

Both potential adverse and beneficial impacts to property values would be less under Sub-alternative A1 when compared to the Proposed Action. Due to the location and reduced size of the Project Area footprint, there would be no private land within 0.6 mile of the Project Area. As indicated in Section 4.12.2.2.3, an industrial facility situated within 0.6 mile from a private property residence could be subject to a slight decrease in property values. Beneficial impacts to property values as a result of housing near the workplace would be less likely under Sub-alternative A1, because jobs would be fewer and housing would be further from the Project Area.

4.12.2.4.3 Public Services

Construction

Similar to the Proposed Action, the construction phase of Sub-alternative A1 would not result in an increase in demand for public services. Current police, fire, and medical facilities should be sufficient to handle emergencies during construction activities at the site. Construction workers would be expected to obtain health insurance from their employers.

Operations

As discussed under the Proposed Action, the population would not be expected to change noticeably as a result of the operations of the facility, and therefore pressure on the local emergency services would also not change substantially. The services provided by Buckeye Fire Department, Buckeye Valley Fire District, and Buckeye Police Department would not be expected to be affected by the SSEP facility operation.

The long-term operations would require the use of fewer natural resources (water and natural gas) and have less of an impact on local utilities with regard to the delivery/transmission of water and power to the Project Area when compared to the Proposed Action. Sub-alternative A1 would require 98.5% less groundwater use than the Proposed Action. Under Sub-alternative A1, no natural gas would be required to operate the facility, in contrast to the Proposed Action, which would require an annual maximum use of 3,982,000 MMBtu.

4.12.2.4.4 Quality of Life

Construction

Changes to the quality of life for nearby residents would be similar in nature to those described for the Proposed Action, but of a lesser intensity. Although the footprint of the proposed project would be reduced from approximately 3,620 to approximately 2,013 acres, the duration of the construction phase would be identical to the Proposed Action. During the construction phase, traffic would increase in the communities near the Project Area. At the peak of construction, approximately 267 vehicles carrying workers would commute to and from the Project Area on a daily basis compared to 1,000 vehicles under the Proposed Action. Approximately 10–14 trucks per day would make trips to the site compared to 30–60 trucks per day under the Proposed Action. See Section 4.15 for further detail on the transportation and traffic analysis. Construction noise levels under Sub-alternative A1 would be similar to the Proposed Action in terms of duration and intensity (see Section 4.9 for detailed information on receptor locations). From a visual perspective, the Sub-alternative A1 would change the landscape characteristics, existing landforms, and vegetation in the area, which would contribute to an overall change in the sense of place for members in nearby communities. However, the change in landscape characteristics would be reduced under Sub-alternative A1 because the Project Area footprint would decrease by approximately 1,700 acres when compared to the Proposed Action.

Individuals seeking solitude and a primitive recreation experiences would be adversely impacted by the views and noise from the SSEP during construction and operation, as they would hear the noise from construction and operations and see the change in landscape. Conversely, new and improved roads and utility corridors surrounding the SSEP would provide for more opportunities for motorized travel, and Sub-alternative A1 would therefore be perceived as a beneficial recreational impact to an OHV user group. Overall, the shift from a rural, moderately developed landscape to a more industrialized landscape would adversely impact local residents and visitors to the area who are seeking a rural to moderately developed residential community, semiprimitive views, or recreation experiences.

Operations

Although the footprint of the Project Area would be reduced from approximately 3,620 acres to approximately 2,013 acres under Sub-alternative A1, the overall change in land use to the area would have similar quality of life impacts when compared to the Proposed Action. The installation and operation of a utility-scale solar facility would result in a change in an individual's identification with the area, because the SSEP would change the existing land use from one that users have historically identified with to a more industrialized land use. The long-term operation of the SSEP could lead to a change in the nearby communities' self perception, from identifying with an area that is rural and moderately developed to identifying with a place shaped by industry and renewable energy development.

The industrial nature of the long-term operation may adversely impact those residents and visitors to the area who have previously identified with the area as a moderately developed, rural landscape. Those members of the community who have an adverse reaction to a change in their perceived quality of life may choose to move from the area. People who are seeking to relocate to a rural or moderately developed community, such as Goodyear or Buckeye, may not be attracted to the area and may choose to live elsewhere.

4.12.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

The social impacts (population and housing) under Alternative B would be largely the same as under the Proposed Action. Under Alternative B, the nonmigratory workforce required to construct and operate the SSEP would be 10% less than the Proposed Action. The annual maximum natural gas usage under Alternative B would be 2,655,000 MMBtu, a 33% decrease in natural gas use when compared to the Proposed Action. Quality of life impacts would be the same under Alternative B as under the Proposed Action because the change in land use, although decreased by approximately 30% compared to the Proposed Action, would be the same as under the Proposed Action.

4.12.3 Economic Impacts

4.12.3.1 NO ACTION

Under the No Action alternative, the SSEP would not be built, and impacts to local economic conditions would be similar to current conditions. The per-AUM-fees obtained by the BLM on the two grazing allotments would remain the same, and local direct and indirect economic impacts from the grazing operations would be similar to current impacts (Section 4.12.4.1). The direct and indirect economic impacts that come from the sale of materials, supplies, and labor related to livestock grazing in the area would remain the same under the No Action alternative. Revenue generated as a result of the dispersed recreation in the area would continue under the No Action alternative.

4.12.3.2 PROPOSED ACTION

4.12.3.2.1 Construction

SSEP construction would create positive, temporary impacts on local economies. Benefits associated with construction would last for the duration of the construction phase of the SSEP, or approximately 39 months. The economic impacts of the SSEP construction phase were estimated with an input-output model, specifically the IMPLAN modeling software and databases (Minnesota IMPLAN Group [MIG] 2009). These types of regional economic models are standard approaches to measuring the production and consumption linkages in an economy among households, industries, and institutions (such as government), thus providing an estimate of the ripple effects in an economy associated with a direct stimulus or investment. IMPLAN's multipliers measure these downstream or ripple impacts.

Maricopa County was chosen as the economic impact study area because construction employees and supporting industries are most likely to reside within Maricopa County given the concentration of available workforce. The data for Maricopa County were obtained from MIG, and multipliers were constructed by the IMPLAN model for the county. IMPLAN multipliers are defined as the sum of the direct, indirect, and induced effect divided by the direct impact. These impact types are further defined below:

- **Direct Impacts**: The set of investments resulting from activity in the geographic location of the county, which are run through the IMPLAN model as the direct effect. During the construction phase, these direct impacts include construction employment and local expenditures on construction supplies and materials.
- **Indirect Impacts**: The inter-industry impacts measuring the economic activity associated with the directly impacted industries selling and purchasing goods and services to and from other industries. The indirect impacts associated with construction investments include industries that support this type of activity, such as truck transportation, engineering and architectural services, wholesale trade, and asphalt manufacturing.
- **Induced Impacts**: The effects of increased consumer and household spending resulting from the direct and indirect income changes. The induced effects would be indirect construction industry employees spending their income in the local economy.

The analysis estimated the total economic impacts (direct, indirect, and induced) associated with construction employment, as well as construction expenditures for supplies and materials paid to businesses in the Phoenix region. Construction industry impacts were estimated for Maricopa County based on the projected average annual construction employment of the SSEP construction phase of 874 full-time equivalents, as described in Section 4.12.2.2.1, and run through the relevant sector in the IMPLAN model (MIG 2009). Local expenditures for construction materials and supplies would total approximately $19 million over the 39-month construction phase, or approximately $5.8 million annually. Construction materials and supplies purchased locally would include concrete, rebar, asphalt, fencing, gravel, hardware, conduits, and local purchases in support of field staff. These expenditures were run through the wholesale trade sector in IMPLAN.

Direct employment, resulting from the construction phase of the SSEP, would be approximately 904 jobs, comprising 874 construction jobs and an additional 30 jobs associated with local construction expenditures ($19 million). Additionally, these direct impacts would support 702 induced and indirect jobs each year for the duration of the construction phase (MIG 2009). Total annual labor income for the project would be approximately $84 million. Economic output, also defined as gross sales or revenues, would be approximately $221.6 million associated with direct, indirect, and induced economic impacts. These IMPLAN-estimated increases in employment, labor income, and economic output as a result of project construction are summarized in Table 4.63. Table 4.64 compares the annual economic impacts from the SSEP during construction per alternative.

Table 4.63 Annual Construction Economic Impacts (2009$) – Proposed Action

Impact	Employment	Labor Income	Output
Direct	904	$50,886,152	$124,243,651
Indirect	271	$15,656,025	$40,537,237
Induced	431	$17,860,035	$56,840,948
Total	**1,606**	**$84,402,211**	**$221,622,804**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Table 4.64 Annual Economic Impacts from SSEP Construction per Alternative (2009$)

Alternative	Employment	Labor Income	Output
No Action	–	–	–
Proposed Action	1,606	$84,402,211	$221,622,804
Alternative A: Reduced Water Use (dry-cooled CST)	1,606	$84,402,211	$221,622,804
Sub-alternative A1: Photovoltaic	639	$36,118,518	$88,753,140
Alternative B: Reduced Footprint	1,445	$75,961,990	$199,459,652

The top industries benefiting from increased employment would consist of (in decreasing order): construction, wholesale trade, food services and drinking establishments, real estate, offices of physicians and dentists, private hospitals, retail sales, employment services, and transportation by truck.

Construction of the SSEP under the Proposed Action would result in a 4.5% decrease in acres available for livestock grazing within the Arnold allotment and a 2.6 % decrease in the Beloat allotment. It should be noted that allotments are used only when there is an adequate amount of water to sustain the AUM and have not historically been used to full capacity because of their lack of water (see Section 4.8 for further details on the ephemeral allotments). It is unlikely that a combined 7.1 % decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations in the area because 92.9% of the allotments would still be available for grazing and the generation of grazing-related revenues.

Although construction of the SSEP would displace both motorized and nonmotorized recreation uses on approximately 3,500 acres and on 7.4 miles of primitive roads, there are substantial public lands adjacent and nearby to the Project Area that would provide continued recreation opportunities for resident of nearby communities and other visitors. Recreation use would be expected to shift to other areas and sales of products and services that support outdoor recreation activities would not be expected to decline. Residents and visitors would be expected to continue to purchase products and services and use those on other nearby public lands.

4.12.3.2.2 Operations

As stated previously, there would be approximately 80 full-time operations staff needed to operate and maintain the SSEP facility. This staff would consist of plant operators, maintenance technicians, and administrative personnel with a total payroll of $8.5 million annually, which includes benefits and incentive pay. Most of the 80 employees would be hired locally, with some (approximately 5 to 10) specialized employees coming from outside the local area.

These employment estimates were run through the IMPLAN model (the Electric Power Generation and Transmission Sector) to estimate direct, indirect, and induced impacts of the operations workforce on the local economy. This is a standard regional economic input-output model that is used to estimate multiplier effects on a local economy from a direct stimulus or investment. The IMPLAN Maricopa County model estimated an additional 128 part-time and full-time jobs (indirect and induced) generated by the operation of the SSEP. In total, SSEP operations would support approximately 208 jobs annually, $71.5 million in annual economic output (or sales), and $16.9 million in annual labor income (MIG 2009). Table 4.65 summarizes these IMPLAN-estimated increases in annual jobs and annual economic output as a result of project operations. Table 4.66 compares the annual economic impacts from the SSEP per alternative.

Table 4.65 Annual Economic Impacts from SSEP Operations (2009$) – Proposed Action

Impact	Employment	Output	Labor Income
Direct	80	$54,917,394	$11,143,831
Indirect	43	$5,983,076	$2,153,936
Induced	85	$10,554,288	$3,559,302
Total	**208**	**$71,454,759**	**$16,857,069**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Table 4.66 Annual Economic Impacts from SSEP Operations per Alternative (2009$)

Alternative	Employment	Output	Labor Income
No Action	–	–	–
Proposed Action	208	$71,454,759	$16,857,069
Alternative A: Reduced Water Use (dry-cooled CST)	208	$71,454,759	$16,857,069
Sub-alternative A1: Photovoltaic	42	$14,290,951	$3,371,414
Alternative B: Reduced Footprint	183	$62,522,914	$14,749,935

In addition to economic contributions of the operations workforce on the local economy, the Proposed Action would also have an impact on nonpayroll operational expenditures on the local economy. Annual expenditures for contracted maintenance and general and administrative supplies would also contribute to the local economies. These annual operating expenditures were run through the IMPLAN economic model to assess contributions of nonpayroll expenditures on the local economy. They are as follows:

- $1.5 million: wholesale trade (general administrative supplies and purchases)
- $775,000: repair and maintenance construction of nonresidential structures

The economic model estimated that an additional 27 part-time and full-time jobs would be generated by the annual nonpayroll operational expenditures of the Proposed Action. In total, the Proposed Action's operations would be expected to support approximately $4.0 million in annual economic output (or sales), and $1.6 million in annual labor income (MIG 2009). Table 4.67 summarizes these IMPLAN-estimated economic impacts.

Table 4.67 Annual Economic Impacts from Proposed Action Operations Nonpayroll Expenditures (2009$)

Impact	Employment	Output	Labor Income
Direct	14	$2,346,236	$967,767
Indirect	5	$695,741	$278,673
Induced	8	$991,405	$334,149
Total	27	$4,033,485	$1,580,607

Source: MIG (2009).

Note: IMPLAN employment impacts include both full-time and part-time employment.

Under the Proposed Action, the maximum annual output of electrical generation would be 1,155,000 MWh (Table 4.68). The amount of energy generated by the SSEP would facilitate economic growth in the region by contributing to the development of infrastructure needed in growing communities. The energy produced by the SSEP would allow energy suppliers to meet the demands of the area's increasing population and a growing economy. According to the U.S. Energy Information Administration, in 2007 the average Arizona household consumed 1,095kWh (1.095 MWh) per month or 13,140 kWh (13.14 MWh) annually (USEIA 2010). For comparative purposes, an assumption can be made that all of the energy produced by the SSEP would supply residential users (although the actual distribution on energy generated by the SSEP is unknown at this time). Under the Proposed Action, the energy generated from the SSEP would supply 87,899 homes annually.

Table 4.68 Maximum Annual Output per Alternative (MWh) – All Alternatives

Alternative	MWh	Number of Residential Units Supplied
No Action	–	–
Proposed Action	1,155,000	87,899
Alternative A: Reduced Water Use (dry-cooled CST)	1,051,050	79,988
Sub-alternative A1: Photovoltaic	775,000	**58,980**
Alternative B: Reduced Footprint	770,000	**58,599**

4.12.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, short-term economic impacts from construction would be the same as the Proposed Action, because the construction and operation employment requirements (and subsequent direct, indirect and induced impacts) would be identical to the Proposed Action. The maximum annual output of electrical generation would decrease by 9% (to 1,051,050 MWh) when compared to the Proposed Action (see Table 4.68). A 9% decrease in the maximum annual output of electrical generation would result in a decrease in the ability of the region to provide infrastructure for economic growth. Alternative A would provide electricity to 79,988 homes annually, a decrease of 7,911 homes when compared to the Proposed Action.

4.12.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.3.4.1 Construction

Under Sub-alternative A1, the positive, short-term impacts on local economies would be reduced compared to the Proposed Action. Although the 39-month construction duration would be the same under Sub-alternative A1, the total direct, indirect, and induced impacts of the construction would be reduced. Average, annual direct employment resulting from the construction phase of Sub-alternative A1 would result in 358 jobs, comprising 335 construction jobs and an additional 23 jobs associated with the local construction expenditures ($14 million). Additionally, this direct employment would support 281 induced and indirect jobs each year for the duration of the construction phase (MIG 2009). Sub-alternative A1 would produce a total of 639 jobs, which is a 60% decrease in the total number of jobs than would be produced under the Proposed Action (1,606 jobs). Total labor income would be reduced 57% from $84.4 million to $36.1 million under Sub-alternative A1. The total economic output would be reduced 60% from $221.6 million to $88.8 million over the duration of the construction phase. Table 4.69 summarizes the construction (IMPLAN-estimated) economic impacts of Sub-alternative A1. A comparison of construction-related economic impacts across all alternatives is provided in Table 4.64.

Table 4.69 Construction Economic Impacts (2009$) – Sub-alternative A1

Impact	Employment	Labor Income	Output
Direct	358	$21,762,313	$49,847,949
Indirect	109	$6,713,679	$16,220,736
Induced	172	$7,642,527	$22,684,225
Total	639	$36,118,518	$88,753,140

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Identical to the Proposed Action, the top 10 industries that would benefit from increased employment under Sub-alternative A1 are (in decreasing order): construction, wholesale trade, architectural and engineering services, food services and drinking places, real estate, truck transportation, offices of physicians and dentists, private hospitals, retail stores, and employment services.

Under Sub-alternative A1, the amount of land available for livestock grazing in the Beloat and Arnold allotments would be reduced by approximately 1,983 acres in the Sub-alternative A1 footprint. However, the amount of land available for grazing would be 63% higher than under the Proposed Action. Sub-alternative A1 would result in a 1.0% (1,051 acres) reduction in acres available for grazing in the Beloat allotment, compared to a 2.6% decrease under the Proposed Action and a 4.0% (932 acres) decrease in the in the Arnold allotment, compared to a 4.5% decrease under the Proposed Action. Similar to the Proposed Action, it is unlikely that a combined 5.0% decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations, because 95% of the two allotments combined would still be available for grazing and for the generation of grazing-related revenues.

4.12.3.4.2 Operations

Under Sub-alternative A1, the positive, long-term impacts on local economies would be reduced as compared to the Proposed Action. As stated previously, there would be approximately 16 full-time operations employees needed to operate and maintain the solar facility under Sub-alternative A1. Because operations would involve a phased approach, it is likely that the 16 employees would be needed in 2015,

and fewer employees would be needed in 2013 and 2014 while operations ramp up. These employees would consist of plant operators, maintenance technicians, and administrative personnel with a total payroll of $1.5 million annually, which includes benefits and incentive pay. Most of the 16 employees would be hired locally, with some specialized employees coming from outside the local area.

These employment estimates were run through the IMPLAN economic model to estimate direct, indirect, and induced impacts of this economic activity on the local economy. The model estimated that an additional 26 part-time and full-time jobs (indirect and induced) would be generated by the full operation of Sub-alternative A1 in 2015. In total, Sub-alternative A1 operations would be expected to support approximately 42 jobs annually, $14.3 million in annual economic output (or sales), and $3.4 million in annual labor income (MIG 2009). Sub-alternative A1 would produce a total of 42 jobs, which is an 80% decrease in the total amount of jobs that would be produced under the Proposed Action (208 jobs). The SSEP increase in total labor income would be reduced 80% from $71.4 million to $14.2 million under Sub-alternative A1, as compared to the Proposed Action. The total increase in economic output from the SSEP would be $3.3 million over the duration of the operations phase. Although beneficial, the impact would be reduced 80% from the $16.8 million of the Proposed Action. Table 4.70 summarizes these IMPLAN-estimated economic impacts of operations-related employment. A comparison of construction-related economic impacts across all alternatives is provided in Table 4.64.

Table 4.70 Annual Economic Impacts from SSEP Operations Employment – Sub-alternative A1 (2009$)

Impact	Employment	Output	Labor Income
Direct	16	$10,983,478	$2,228,766
Indirect	9	$1,196,615	$430,787
Induced	17	$2,110,858	$711,861
Total	**42**	$14,290,951	$3,371,414

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Sub-alternative A1 would also include additional annual operational expenditures, which were analyzed with the IMPLAN economic model. In addition to the operations payroll, there would be annual expenditures for consumables, waste disposal, utilities, contracted maintenance, and general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). These annual operating expenditures were run through the IMPLAN economic model to assess contributions of nonpayroll expenditures on the local economy. They are as follows:

- $800,000: facility support services
- $275,000: wholesale trade (general administrative supplies and purchases)
- $1.5 million: repair and maintenance construction of nonresidential structures

The economic model estimated an additional 41 part-time and full-time jobs generated by the annual nonpayroll operational expenditures of Sub-alternative A1. In total, Sub-alternative A1 operations would support almost $5.0 million in annual economic output (or sales) and $2.1 million in annual labor income (MIG 2009). Table 4.71 summarizes these IMPLAN-estimated economic impacts.

Table 4.71 Annual Economic Impacts from Operations Nonpayroll Expenditures (2009$) – Sub-alternative A1

Impact	Employment	Output	Labor Income
Direct	25	$2,749,112	$1,334,153
Indirect	6	$868,575	$350,594
Induced	10	$1,340,167	$451,682
Total	41	$4,957,855	$2,136,434

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

In total, both operations payroll and annual operating expenditures would support 83 jobs, $5.5 million in labor income, and $19.2 million in economic output.

Under Sub-alternative A1, the maximum annual output of electrical generation would total 775,000 MWh, a 33% decrease from the Proposed Action (Tables 4.68). This reduction in electrical generation would result in the smallest increase in ability, among the action alternatives, to provide infrastructure for economic growth. The amount of electricity generated under Sub-alternative A1 would supply 58,980 homes with electricity annually, 28,919 less homes than the Proposed Action.

4.12.3.5 ALTERNATIVE B: REDUCED FOOTPRINT

4.12.3.5.1 Construction

Construction operations under Alternative B would require a total construction period of approximately 37 months (2 months less than under the Proposed Action). A peak workforce of 1,350 workers (a 10 % reduction in the workforce compared to the Proposed Action) would be required under Alternative B. Compared to the Proposed Action, increases in employment, labor income, and economic output as a result of construction of the SSEP would be 10% less under Alternative B (see Tables 4.64 and 4.72). Compared to the Proposed Action, a two-month reduction in the construction phase would result in an annual decrease of $30,603,373 in labor income and sales generated as a result of the shorter construction timeframe under Alternative B.

Table 4.72 Annual Construction Economic Impacts (2009$) – Alternative B

Impact	Employment	Labor Income	Output
Direct	814	$45,797,537	$111,819,286
Indirect	243	$14,090,426	$36,483,513
Induced	388	$16,074,032	$51,156,853
Total	**1,445**	**$75,961,990**	**$199,459,652**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Under Alternative B, impacts to the amount of land available for livestock grazing in the Beloat and Arnold allotments would be reduced by 2,320 acres in the Alternative B footprint. However, the amount of land available for grazing would increase by 61% when compared to the Proposed Action. Alternative

B would result in a 1.3% (1,397 acres) reduction in acres available for grazing in the Beloat allotment, compared to a 2.6% decrease under the Proposed Action and a 4.2% (966 acres) decrease in the in the Arnold allotment, compared to a 4.5% decrease under the Proposed Action. Similar to the Proposed Action, it is unlikely that a combined 5.5% decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations, because 94.5% of the two allotments combined would still be available for grazing and the generation of grazing-related revenues.

4.12.3.5.2 Operations

Under Alternative B, operations would require 70 full-time employees, a 12.5% reduction in the amount of employees required compared to the Proposed Action. Annual and long-term increases in employment and economic output (direct, indirect, and induced) from the SSEP operations under Alternative B would be reduced by 12.5% when compared to the Proposed Action (Table 4.73).

Table 4.73 Annual Economic Impacts from SSEP Operations – Alternative B

Impact	Employment	Output	Labor Income
Direct	70	$48,052,720	$9,750,852
Indirect	38	$5,235,192	$1,884,694
Induced	75	$9,235,002	$3,114,389
Total	**183**	**$62,522,914**	**$14,749,935**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Under Alternative B, the maximum annual output of electrical generation would total 777,000 MWh, a 32% decrease from the Proposed Action (Tables 4.68). This reduction in electrical generation would result in the smallest increase in ability, among the action alternatives, to provide infrastructure for economic growth. The amount of electricity generated under Alternative B would supply 58,599 homes with electricity annually, 29,300 less homes than the Proposed Action.

4.12.4 Fiscal Impacts

4.12.4.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed, and the existing land uses would continue. The BLM would continue to collect grazing fees from the two permittees who have allotments in the Project Area. The grazing fees would continue to support the costs of the federal grazing program. The Beloat allotment totals 103,508 acres and 2,988 AUMs. The Arnold allotment totals 23,290 acres and 984 AUMs. The 2010 annual grazing fee, collected by the BLM, is $1.35/AUM. The Beloat allotment currently generates $4,034.00 in grazing fees and the average annual fee for the Arnold allotment is $1,328.00. The average annual maximum fee for the two allotments in the SSEP currently equals $5,362.00

4.12.4.2 PROPOSED ACTION

4.12.4.2.1 Construction

Local purchases of materials, supplies, equipment, and services would total $19 million during the construction phase of the project, which would last approximately 39 months. These expenditures would be subject to sales tax in the location where they are purchased. Currently, the State of Arizona has a sales tax rate of 5.6%, and Maricopa County levies an additional tax of 0.7% to support roads and jails (Hedding 2009). As a result of these taxes, locally purchased construction materials and supplies would contribute $1.1 million and $133,000 to the State of Arizona (the General and Detention Operation Funds) and Maricopa County, respectively, over the 39-month construction period.

Each city in the region also adds an additional sales tax, and it is likely that materials and supplies would be purchased from the cities in the Phoenix metropolitan area. These cities assess various sales tax rates, generally ranging from 1.5% to 3.0%. Although the exact jurisdiction is unknown at this time, these local construction expenditures would contribute from $285,000 to $570,000 in city sales tax revenue over the 39-month construction phase of the project.

Additionally, in Arizona, prime contractors are subject to a transaction privilege tax. The transaction privilege tax is one that is levied by the State of Arizona on contractors for the privilege of conducting business in the state. The current combined state and county tax rate for prime contracting is 6.3% (Arizona Department of Revenue 2009b); the tax base for prime contracting is 65% of the sales proceeds or income derived from the job. To assess the transaction privilege tax receipts, the construction payroll estimate of $215 million is used as a proxy for construction sales. Applying both the tax base and transaction privilege tax rates to the construction payroll spending of $215 million, the SSEP would contribute approximately $8.8 million to the state and county in tax revenue over the entire construction phase of the SSEP. Most of the larger cities within Maricopa County also license and collect privilege tax independently of the state; these city rates typically range from 2 to 4%, which would contribute another $2.8 to $5.6 million to city governments over the construction period.

Construction and operation of the SSEP, under the Proposed Action, would result in a 4.5% decrease in acres available for grazing within the Arnold allotment and a 2.6% decrease in the Beloat allotment compared to the No Action alternative. Assuming a 7.1% reduction in acres available for grazing equates to a 7.1% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 7.1% or $381.00 (a decrease of $105.00 for the Beloat allotment and an average annual decrease of $60.00 for the Arnold allotment).

Construction and operation of the SSEP would also result in the loss of about 3,500 acres and 7.4 miles of primitive roads in the Project Area for recreation uses. Because residents of nearby communities and visitors to the area would be expected to continue to recreate on other adjacent and nearby public lands, they would continue to purchase products and services that generate tax revenue to the State of Arizona. The contribution of existing outdoor recreation activities in the Project Area to Arizona's tax base is unknown, but it would not be expected to decline because use would shift to other nearby public lands and these products and service would still be needed and purchased.

4.12.4.2.2 Operations

The 125-MW unit would begin operations in mid 2013, whereas the 250-MW unit would begin operations in mid 2014. During full operation of the facility, local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $11.2 million annually. Within this annual sum, roughly $5.6 million would be used for contracted construction and maintenance services; $5.2 would be used for other facility support services, such as waste disposal, utilities, land maintenance, and others; and $325,000 would be used for general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). The $325,000 would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), and would contribute $17,920 to the state and $2,227 to the county annually.

Applying both the tax base and transaction privilege tax rates to the $5.6 million annual contracting spending under the Proposed Action, the project would contribute approximately $158,800 to the state and county in tax revenue. The license and privilege tax collected by larger cities in Maricopa County would contribute $40,000 to $80,000 to city governments.

Arizona has two components of property or ad valorem taxes, primary and secondary. Primary property taxes can be collected by the state, counties, cities, and community colleges or school districts, and are dedicated for operation and maintenance expenditures within the respective jurisdiction. Secondary property taxes may be levied for voter-approved budget overrides, special districts, or to pay for bonded indebtedness (Arizona Department of Revenue 2009a). Property taxes apply to real property as well as to secured and unsecured personal property. Arizona's property tax system classifies property according to its usage, and each class of property is assigned an assessment ratio, ranging from 1% to 25% (Arizona Department of Revenue 2009a).

The Centrally Valued Properties Unit of the Arizona Department of Revenue is responsible for the annual valuation of 13 industries for ad valorem property tax purposes, including mines, utilities, agricultural railroads, airlines, and other large and more complex properties (Arizona Department of Revenue 2009a). Utilities are typically assessed at 23% of their annual valuation for ad valorem tax purposes, although renewable energy equipment owned by utilities and other entities operating in Arizona is assessed at 20% of its depreciated cost for the purpose of determining property tax payments to the state (DOE 2009b).[10]

The property tax primary rate is $5.69 and the secondary rate is $2.94 per $100 of assessed value in Maricopa County (Arizona Department of Revenue 2009a). A total of $8.63 in primary and secondary tax rates per $100 in assessed valuation is levied by the following revenue recipients (Arizona Department of Revenue 2009):

- School district – 53.8%
- Counties – 20.0%
- State – 0.3%
- Cities – 9.2%
- Community colleges – 10.8%
- Special districts – 5.7%

[10] *Renewable energy equipment* is defined as "electric generation facilities, electric transmission, electric distribution, gas distribution or combination gas and electric transmission and distribution and transmission and distribution cooperative property that is located in this state, that is used or useful for the generation, storage, transmission or distribution of electric power, energy or fuel derived from solar, wind or other nonpetroleum renewable sources not intended for self-consumption, including materials and supplies and construction work in progress, but excluding licensed vehicles and property valued under sections 42-14154 and 42-14156" (DOE 2009b).

The fully installed solar field is estimated to cost $1.45 billion. This cost does not reflect the cost of the power plant, piping, or other SSEP equipment. If 20% of the initial cost is considered the assessed value of this equipment, $25 million in primary and secondary property taxes could accrue to the county, cities, colleges, and school districts in Maricopa County. Consistent with the percentages reported above, it is possible that the county would receive approximately 20% of the assessed value, whereas the Town of Buckeye could receive 9.2%, or $7.6 million and $3.9 million, respectively. As this equipment is depreciated, the annual tax revenue would decrease.

The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre (BLM and DOE 2010). Because the Proposed Action footprint is approximately 3,620 acres, the annual rental fee paid to the BLM would be $696,858. The rental fees would be adjusted or inflated each year, based on the Implicit Price Deflator-Gross Domestic Product index.

The BLM also charges a MW capacity fee that captures the increased industrial-use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for concentrated solar-power projects is $6,570 per MW to be implemented over a five-year period after the start of generation. With phased operations estimated to begin in 2013, the ramp-up period (at 20% of generation fee added per year for five years) is likely to occur between 2013 and 2020. In 2013, the capacity fee would be $164,250 (with 20% the first year, 125 MW, and $6,570 per MW). Over the seven-year period between 2013 and 2020, the capacity fee would be $2,463,780 annually.

4.12.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Fiscal impacts would be the same under Alternative A as under the Proposed Action, because the duration of construction and workforce required for construction and operations would be identical under both of these alternatives.

4.12.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.4.4.1 Construction

Under Sub-alternative A1, the local purchases of materials, supplies, and services would total $14 million over the 39-month period construction phase. This would be a 26% decrease in local purchases when compared to the Proposed Action. Local purchases under Sub-alternative A1 would contribute $798,000 and $98,000 to the state and county, respectively, over the construction period. City sales tax revenue would contribute $210,000–$420,000 over the 39-month construction phase. The sales tax contribution would be 26% less than the contributions of the Proposed Action.

The transaction privilege tax receipts would decrease under Sub-alternative A1 when compared to the Proposed Action. Applying both the tax-based and transaction privilege tax rates to the construction payroll spending of $75 million, Sub-alternative A1 would further contribute $3.1 million, 64% less than the Proposed Action, to the state and county in tax revenue over the entire construction phase. Larger cities in the Phoenix region also license and collect privilege tax independently of the state and county and would receive $1.5–$3.0 million over the construction period.

Construction and operation of the SSEP, under the Sub-alternative A1, would result in a 4.0% decrease in acres available for grazing within the Arnold allotment and a 1.0% decrease in the Beloat allotment compared to the No Action alternative. Assuming a 5.0% reduction in acres available for grazing equates to a 5.0% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 5.0% or $93.00 (a decrease of $40.00 for the Beloat allotment and an average annual decrease of $53.00 for the Arnold allotment).

4.12.4.4.2 Operations

Operation of the entire 300-MW PV facility is expected to start in mid-2015, with partial operations occurring in 2013 and 2014. During full operation of the facility, local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $2.6 million annually, a 76% decrease in local purchases compared to the Proposed Action. Within this annual sum, roughly $1.5 million would be used for contracted construction and maintenance services; $800,000 would be used for other facility support services, such as waste disposal, utilities, land maintenance, and others; and $275,000 would be used for general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). In 2013 and 2014, a portion of these expenditures would occur as the operations phase of the project gets underway.

General and administrative supplies and purchases of $275,000 would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), contributing $15,400 to the state and $1,925 to the county annually under Sub-alternative A1. The transaction privilege tax receipts during the operations phase would decrease under Sub-alternative A1 when compared to the Proposed Action. Applying both the tax-base and transaction privilege tax rates to the $1.5 million annual contracting spending Sub-alternative A1 would further contribute $61,425 to the state and county in tax revenue over the entire operations phase. Larger cities in the Phoenix region also license and collect privilege tax independently of the state and county, which typically ranges from 2% to 4%, contributing another $19,000–$39,000 to city governments.

As described in the Proposed Action (Section 4.12.4.2.2), solar panels, equipment, and facilities would be assessed in terms of their valuation and would be subject to the collection of country and city property taxes. The fully-installed PV solar panels and arrays and other facilities and equipment are estimated to cost $900 million (personal communication, John Bulich, Engineer, Nextera Energy Resources 2011). If 20% of the initial cost is considered the assessed value of this equipment, $15.5 million in primary and secondary property taxes could accrue to the county, cities, colleges, and school districts in Maricopa County. Consistent with the percentages reported in the Proposed Action analysis (Section 4.12.4.2.2), it is possible that the county would receive approximately 54%, whereas the Town of Buckeye could receive 9.2%, or $8.4 million and $1.4 million, respectively. As this equipment is depreciated, this annual tax revenue would decrease. The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of the FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre. Because the Sub-alternative A1 Project Area would total approximately 2,013 acres, the annual rental fee paid to the BLM would be $376,680, a 45% decrease or $320,178 less in rental fees when compared to the Proposed Action.

The BLM also charges a MW capacity fee that captures the increased industrial use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for PV solar projects is $5,256

per MW to be implemented over a five-year period after the start of generation. With phased operations over a three-year time period beginning in 2013, the ramp-up period (at 20% of generation fee added per year) would likely occur between 2013 and 2020. In 2013, the capacity fee would be approximately $105,120 (with 20% the first year, 100 MW, and $5,256 per MW). After 2020, the capacity fee would be $1,576,800 annually, a 36% decrease or $886,980 less in annual MW capacity fees when compared to the Proposed Action.

4.12.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

4.12.4.5.1 Construction

Local purchases of materials, supplies, equipment, and services are expected to total $18 million during the construction phase of the project under Alternative B, which would last approximately 37 months. When compared to the Proposed Action, this is a two month or 5% decrease in construction duration. Locally purchased construction materials and supplies would contribute $1.04 million and $126,350 to the State of Arizona (the General and Detention Operation Funds) and Maricopa County, respectively, over the 37-month construction period.

Under Alternative B, the workforce and subsequent payroll would be reduced by 10%, compared to the Proposed Action, during the construction phase. Applying both the tax base and transaction privilege tax rates to the construction payroll spending of $193 million, the SSEP would contribute approximately $7.9 million to the state and county in tax revenue over the entire construction phase of the SSEP. Most of the larger cities within Maricopa County also license and collect privilege tax independently of the state; applying these city rates, implementation of the project under Alternative B would contribute another $2.5 to $5 million to city governments over the 37-month construction period.

Alternative B would result in a 5.5% decrease in the acres available for grazing when compared to the No Action alternative. Assuming a 5.5% reduction in acres available for grazing equates to a 5.5% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 5.5% or $294.00 under Alternative B.

4.12.4.5.2 Operations

Fiscal contributions to the state and county from sales and use taxes would be less under Alternative B than under the Proposed Action because there would be a 12.5% decrease in the workforce and a 30% decrease in the need for materials and supplies when compared to the Proposed Action. During operation it is expected that local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $7.84 million annually. Within this annual sum, roughly $3.92 would be used for contracted services and $192,000 million would be used for general and administrative supplies. The $192,000 million would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), and would contribute $10,752 to the state and $1,344 to the county annually.

Under Alternative B, revenue to the state and the county from the transaction privilege tax levied on prime contractors would be reduced by 12.5% compared to the Proposed Action, because there would be a 12.5% decrease in the workforce when compared to the Proposed Action. When applying both the tax base and transaction privilege tax rates discussed in Section 4.12.4.2.2 to the $3.92 annual contracting spending, the project would contribute approximately $138,250 to the state and county in tax revenue. Licensing and privilege taxes collected by larger cities in the Phoenix region would contribute an additional $35,000 to $70,000 to city governments.

Ad valorem taxes levied on utilities would be up to 30% less under Alternative B when compared to the Proposed Action because of the reduced size of the operation (a 30% reduction from the Proposed Action).

A fully installed, reduced footprint solar field could cost up to 30% less under Alternative B than under the Proposed Action. As mentioned above, this cost would not reflect the cost of the power plant, piping, or other SSEP equipment. If the assessed value of the total equipment is reduced by 30% compared to the Proposed Action, $17.5 million in primary and secondary property taxes could accrue to the counties, cities, colleges and school districts in Maricopa County. Initially, the county would receive $5.3 million in primary taxes and the Town of Buckeye would receive $2.7 million. As the equipment is depreciated, this estimated annual tax revenue would decrease.

The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre (BLM and DOE 2010). Because the Alternative B footprint is approximately 2,394 acres, the annual rental fee paid to the BLM would be $436,948. The rental fees would be adjusted or inflated each year, based on the Implicit Price Deflator-Gross Domestic Product index.

The BLM also charges a MW capacity fee that captures the increased industrial-use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for concentrated solar-power projects is $6,570 per MW to be implemented over a five-year period after the start of generation. With phased operations estimated to begin in 2013 (with 1 125 MW facility) occur through 2020, the annual capacity fee would be $821,250. With both 125 MW facilities operating at full capacity by 2020, the annual capacity fee would be $1,642,500 under Alternative B.

4.12.5 Environmental Justice Impacts

As described in Section 3.12.5, there are potential EJ populations in nine census blocks within 5 miles of the Proposed Action footprint (Map 18) and the Sub-alternative A footprint. Within each census block, the number of potential EJ populations range from 31 to 125 residents, and there are a total of 612 minority residents within a 5-mile radius of the Proposed Action footprint. The minority populations range from 41 to 125 residents per census block within the 5-mile radius of the Sub-alternative A1 footprint and there are total of 414 minority residents.

The nine census blocks with potential EJ populations within a 5-mile radius of the Proposed Action footprint and the five census blocks within a 5-mile radius of the Sub-alternative A footprint have larger proportions of African American, Hispanic or Latino, Native American, or some other race when compared to populations in Maricopa County and the State of Arizona. These communities lie to the north and slightly east and at least 1.8 miles away from the Project Area. Under Sub-alternative A1, the closest census block with a potential EJ population is approximately 3 miles north of the Project Area.

4.12.5.1 NO ACTION

Under the No Action alternative, adverse impacts to the potential EJ populations would not occur because the current land use would remain unchanged and opportunities for disproportionate adverse impacts would be nonexistent.

4.12.5.2 ALL ACTION ALTERNATIVES

Under all action alternatives, impacts to potential EJ populations would be largely the same because the physical construction and long-term operation of the SSEP would create an opportunity that could induce disproportionately high and adverse impacts to the human health and/or environmental conditions of minority populations. However, Sub-alternative A1 would decrease the number of potential EJ communities potentially impacted by the SSEP because of the reduced project footprint. Under Sub-alternative A1, five census blocks with potential EJ populations would be within the potential impact radius (compared to nine census blocks under the Proposed Action) and a total of 414 residents would be within the potential impact radius (compared to 612 individuals or 32% more people under the Proposed Action). The degree to which potential EJ populations would be impacted is discussed in Table 4.74.

Under many resources, potential adverse impacts resulting from the SSEP would be site specific to the Project Area. Potential EJ populations would not be directly or indirectly impacted by changes to the Project Area. These resources are geology, livestock grazing, paleontology, soils, and vegetation. Resources that may be subject to adverse impacts as a result of the SSEP and have subsequent adverse impacts to potential EJ populations are air, climate, cultural resources, land use, noise, recreation, transportation, visual, and water resources. Consideration as to whether the action alternatives would result in a disproportionate impact to potential EJ populations was given to these resources, and a rationale is provided in Table 4.74.

Table 4.74 Potential Environmental Justice Common to All Action Alternatives

Resources	Adverse Impact/Rationale	Disproportionate Impact/Rationale
Air	Yes	No–Impacts to individuals living in census blocks closer to SSEP would be greater than impacts to potential EJ populations located further from the SSEP
Climate	Yes	No–Impacts not localized to census blocks areas, but region as a whole
Cultural	No – Culturally specific practices and/or sites have not been identified in the Project Area.	–
Geology	No – Impacts limited to Project Area	–
Hazardous	No – Materials would be managed according to laws and regulations within Project Area and transported to appropriate disposal sites	–
Land use	Yes	No–Impacts limited to grazing and recreation land uses within the Project Area
Livestock grazing	No – Impacts limited to Project Area	–
Noise	Yes	No–Impacts to individuals living in census blocks closer to SSEP (within 1.75 miles) would be greater than impacts to potential EJ populations located further from the SSEP
Paleontology	No – Impacts limited to Project Area	–
Recreation	Yes	No–Loss of acres for dispersed recreation not limited to potential EJ populations
Soils	No – Impacts limited to Project Area	–
Special designations	No – Impacts would be felt by all individuals who visit special designation areas, not specific to potential EJ populations	–
Transportation	Yes	No–Increases in traffic would be concentrated along SR-85 and would impact individuals living closer to SR-85 than the potential EJ population who live more than 5 miles from the road
Vegetation	No – Impacts limited to Project Area	–
Visual	Yes	No–Although the SSEP would be visible on KOP 10 (Ray Road) approximately 4 miles from the Project Area and within potential EJ populations, it would be more visible at KOPs, and census blocks closer to the Project Area
Water	Yes	No–Drawdown from wells near potential EJ populations would not exceed the legal requirement of a maximum 10 feet over five years.
Wildlife	No – Loss of wildlife habitat and movement corridors not directly connected to potential EJ populations because they're not dependent on wildlife	–

4.12.6 Potential Mitigation Measures

No mitigation measures are recommended to further decrease or eliminate impacts to social and economic conditions.

4.12.7 Residual Impacts

There would be no mitigation measures for socioeconomics characteristics; therefore, the impacts would be the same as discussed under the alternatives.

4.12.8 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would preclude revenue generated from current livestock grazing. Under all action alternatives, new jobs would be created and income would be generated in varying degrees, throughout the life of the project. Upon termination of the project, the land would be reclaimed and revenues from grazing would resume once the area has been revegetated. However, it could take years before the land is suitable for grazing.

The current quality of life that has developed for nearby communities and visitors via the existing land use would be altered as the landscape shifts from one that is moderately developed and rural in nature to one with a more industrial feel. This change in the quality of life would be felt by individuals living or recreating near the SSEP throughout the life of the project.

4.12.9 Irreversible and Irretrievable Commitments of Resources

There would be irretrievable socioeconomic impacts under all action alternatives because existing livestock grazing and recreation uses would be precluded during the life of the SSEP. Upon termination and reclamation of the site, these uses would return.

There would be no irreversible impacts to socioeconomics under all action alternatives because all affected lands uses would resume upon termination and reclamation of the SSEP and the revenue generated and quality of life derived from the landscape would return to its current condition.

4.13 Soils

4.13.1 Analysis Area and Analysis Assumptions

The analysis area for soils comprises the project footprint, ancillary facilities, and any disturbance areas associated with road improvements or ROWs. The primary soils impacts indicator is the acres of surface disturbance to soils in the analysis area, resulting from the implementation of the action alternatives. Sensitive soils percentages within each alternative footprint are also identified to determine erosion and reclamation potential for the Project Area (Table 4.75). Disturbance to soils would be incurred by development and construction activities, as planned under the action alternatives. The degree of impact would depend on the extent (acres) and duration (permanent versus temporary) of the disturbance. Permanent disturbance to soils would occur on most of the Project Area, including ancillary facilities and transportation corridors. Temporary disturbance to soils would be limited to gas and water line developments and gen-tie) line access roads.

Table 4.75 Parameter Ranges Used to Define Sensitive Soils

Soil Features Restrictive to Rehabilitation	Parameters	Highly Restrictive Range	Moderately Restrictive Range
Water erosion hazard[1]	Kw factor of surface layer and Slope	≥ 0.37 and ≥ 10% or 0.20–0.36 and > 30%	0.20–0.36 and 10%–30% or < 0.20 and > 30%
Wind erosion hazard	Wind erodibility group of surface layer	1,2	3,4,4L
Salinity[2]	Salinity (MMHOS/CM) of surface layer	≥16	8-16
Sodium absorption Ratio[3]	Sodium absorption ratio of surface layer	>13	4–13
Alkalinity	pH	>9.0	7.9–9.0
Rooting depth	Minimum depth to bedrock or hardpan (inches)	<10	10–20
Droughtiness[4]	Available water supply (average to 40 inches)	<0.05	0.05–0.10

[1]K Factor of surface layer adjusted for the effect of rock fragments. Slope is the maximum value for the range of slope of a soil component within a map unit.

[2] Maximum value for the range in soil salinity.

[3] Maximum value for the range in sodium adsorption ratio.

[4] Maximum value for the range of available water capacity for the soil layer; inches of water per inches of soil.

4.13.2 No Action

No new impacts to soils would occur under the No Action alternative; although some soil impacts associated with current livestock grazing practices would continue in the Project Area (see Section 3.8 for further discussion on these allotments). Impacts from grazing would be relatively minor in both extent and severity when compared to the disturbances associated with the construction and operation of the SSEP. Impacts under this alternative would include soil compaction due to grazing, but it would generally be limited to discrete paths or grazing areas, and not the larger area of disturbance that would be impacted under the action alternatives. Recreation in the Project Area, consisting mostly of hiking, horseback riding, and OHV travel, would not be expected to impact soils due to its limited use and general confinement to existing roads and trails.

4.13.3 Proposed Action

Under the Proposed Action, long-term disturbance to soils would occur from the clearing of vegetation, grading of the project footprint to 3% slope, compaction within the project footprint, and from the improvement and construction of roads in the Project Area. Long-term disturbance would occur on approximately 3,588.7 acres. Long-term disturbance to soils in the solar field would occur from approximately 37,000 pounds of herbicide used annually to control vegetation under the Proposed Action. Repeated herbicide use in desert soils can result in the loss of the mineral soil, organic matter, and nutrients due to herbicide impacts to BSC organisms (Zaady et al. 2004). Increased sedimentation of the soil surface and waterways can also result due to the loss of crust organisms that hold the soil in place. Short-term disturbance to soils would occur from the installation of the buried gas and water lines, and from temporary access roads. Short-term disturbance would occur on approximately 31 acres. Tables 4.76 and 4.77 provide a breakdown of total acres of long-term and short-term soil disturbance by soil type under all alternatives. Impacts to soils would include the loss of soil productivity from topsoil loss, erosion, and compaction, the latter of which leads to the loss in the ability for water to infiltrate the soils.

Table 4.76 Acres/Percentage of Long-term Soil Disturbance – All Alternatives

Soil Type	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Denure-Rillito-Why Complex	0 (0.0%)	2,550.3 (71.1%)	2,543.2 (71.0%)	1,401.3 (70.6%)	1,608.7 (68.1%)
Dateland-Cuerda Complex	0 (0.0%)	766.2 (21.4%)	764.6 (21.4%)	525.6 (26.5%)	702.2 (29.7%)
Gunsight-Rillito-Carrizo	0 (0.0%)	269.2 (7.5%)	269.2 (7.5%)	53.5 (2.7%)	49.4 (2.1%)
Denure-Coolidge Complex	0 (0.0%)	2.6 (0.07%)	2.6 (0.07%)	2.6 (0.1%)	2.6 (0.1%)
Gilman Fine Sandy Loam	0 (0.0%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)
Torriofluvents	0 (0.0%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)
Carrizo-Momoli	0	0	0	0.3 (0.01%)	0
Total Acreage	0	**3,588.7**	**3,579.9**	**1,983.8**	**2,363.3**

Note: Acreages may not sum to 100% due to rounding.

Table 4.77 Acres/Percentage of Short-term Soil Disturbance – All Alternatives

Soil Type	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Denure-Rillito-Why Complex	0 (0.0%)	23.8 (76.8%)	22.2 (76.8%)	17.6 (60.0%)	23.1 (76.5%)
Dateland-Cuerda Complex	0 (0.0%)	4.6 (14.8%)	4.2 (14.5%)	8.6 (29.4%)	4.6 (15.2%)
Gunsight-Rillito-Carrizo	0 (0.0%)	2.1 (6.8%)	2.1 (7.3%)	2.1 (7.2%)	2.1 (7.0%)
Denure-Coolidge Complex	0 (0.0%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Gilman Fine Sandy Loam	0 (0.0%)	0.2 (0.6%)	0.2 (0.7%)	0.2 (0.7%)	0.2 (0.7%)
Torriofluvents	0 (0.0%)	0.2 (0.6%)	0.2 (0.7%)	0.2 (0.7%)	0.2 (0.7%)
Carrizo-Momoli	0	0	0	0.5 (1.7%)	0
Total Acreage	0	**31.0**	**28.9**	**29.3**	**30.2**

Note: Acreages may not sum to 100% due to rounding.

Long-term disturbance to soils would be minimized by implementation of a reclamation plan (to be developed by Boulevard) that would contain specifications for regrading the surface of the project footprint to its approximate original condition, and replacing lost topsoil with native topsoil to an acceptable depth. An approved dust suppression treatment (such as gravelling, MgCl, or commercially available polymers) would be used on dirt roadways in and around the solar field, which would reduce the amount of wind erosion.

Short-term disturbance to soils would be minimized by reclaiming all temporarily disturbed areas as close to their pre-construction conditions as possible. Temporary access roads used during construction would be regraded and restored to pre-existing function and grade. BLM-approved seed mixes would be applied to temporarily disturbed areas, as required.

Impacts under the Proposed Action would be considerably greater (3,620 acres) than under the No Action alternative due to the large-scale removal and replacement of soils that would occur during construction and operation activities (which would not occur under the No Action alternative). Long-term impacts to soils would also be greater than under the No Action alternative due to the application of approximately 37,000 pounds of herbicides in the solar field.

Approximately 0.6%–8.2% of long-term disturbance and 33.8%–46.8% of short-term disturbance under the Proposed Action would occur in soils that are "moderately restrictive" for high excess sodium and droughty conditions (Table 4.78 and 4.79). In addition, 99% of both total long-term and short-term disturbance under the Proposed Action would occur in soils with high alkalinity, whereas no disturbance would occur in soils with limited rooting depth or high salinity.

Soils with moderately high wind and water erosion potential would occur on approximately 21.4% of the total long-term disturbance and 15.8% of short-term disturbance under the Proposed Action.

Table 4.78 Acres/Percentage of Long-term Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Water erosion hazard	Moderately restrictive	0 (0.0%)	766.4 (21.4%)	764.8 (21.4%)	525.8 (26.5%)	702.4 (29.7%)
Wind erosion hazard	Moderately restrictive	0 (0.0%)	766.4 (21.4%)	764.8 (21.4%)	525.8 (26.5%)	702.4 (29.7%)
Salinity	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Excess sodium	Moderately restrictive	0 (0.0%)	20.7 (0.6%)	13.6 (0.4%)	15.2 (0.8%)	17.2 (0.7%)
Alkalinity	Moderately restrictive	0 (0.0%)	3,588.5 (99.9%)	3,579.8 (99.9%)	1983.6 (99.9%)	2,363.1 (99.9%)
Rooting depth	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Droughty soils	Moderately restrictive	0 (0.0%)	292.8 (8.2%)	284.1 (8.2%)	51.9 (2.6%)	47.4 (2.0%)

Note: Acreages may not sum to 100% due to rounding.

Table 4.79 Acres/Percentage of Short-tem Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Water erosion hazard	Moderately restrictive	0 (0.0%)	4.9 (15.8%)	4.4 (15.2%)	8.8 (30.0%)	4.9 (16.2%)
Wind erosion hazard	Moderately restrictive	0 (0.0%)	4.9 (15.8%)	4.4 (15.2%)	8.8 (30.0%)	4.9 (16.2%)
Salinity	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Excess sodium	Moderately restrictive	0 (0.0%)	10.5 (33.8%)	8.9 (30.8%)	9.1 (31.1%)	9.7 (32.1%)
Alkalinity	Moderately restrictive	0 (0.0%)	30.8 (99.4%)	28.7 (99.3%)	29.0 (99.0%)	30.0 (99.3%)

Table 4.79 Acres/Percentage of Short-tem Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Rooting depth	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Droughty soils	Moderately restrictive	0 (0.0%)	14.5 (46.8%)	12.5 (43.3%)	0.5 (1.7%)	0 (0.0%)

Note: Acreages may not sum to 100% due to rounding.

Because the Proposed Action would disturb soils over a larger area, more reclamation-limited soils would be affected compared to the No Action alternative, resulting in long-term reduction to soil productivity in areas disturbed by the Proposed Action. Increased erosion rates and decreased soil-infiltration capacity, as a result of sensitive soil disturbance, would potentially impact water quality in the area by increasing sediment and salt concentrations in surface and groundwater resources (see Section 4.18 for a detailed impacts analysis). Revegetation of all disturbed soils (both short-term disturbance and long-term disturbance) would also be of limited success in areas with reclamation-restricted soils, leading to a long-term net loss of native vegetation and an increase in noxious and invasive plant species (see Section 4.16 for a detailed impacts analysis). In the Project Area, the predominant land use is grazing; therefore, anticipated external sources of soil salinity are anticipated to be negligible (see Section 4.7 for a detailed impacts analysis).

4.13.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, a total of 3,579.9 acres of soils would undergo long-term disturbance from operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 8.8 acres). Long-term impacts to soils from the application of herbicides in the solar field would be the same as under the Proposed Action. Short-term disturbance would occur on 28.9 acres, compared to 31.0 acres under the Proposed Action. The elimination of two evaporative cooling ponds under this alternative would result in 9.0 acres less soil disturbance in the long term, and 2.0 acres less in the short term, as compared to the Proposed Action. This reduction would not affect the relative percentage of impact to soil types (as compared to the total acreage of soil disturbance); however, and all other impacts to soil resources under Alternative A would be the same as under the Proposed Action (see Tables 4.76 to 4.79).

4.13.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, a total of 1,983.8 acres of soils would undergo long-term disturbance from operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 1,604.9 acres). Short-term disturbance would occur on 29.3 acres, compared to 31.0 acres under the Proposed Action. This reduction would yield a minor change in the relative percentage of long-term impact to soil types; the Dateland-Cuerda Complex would have a slightly greater percentage of impact as compared to the Proposed Action or Alternative A, whereas the Gunsight-Rillito-Carrizo would have a slightly lower percentage of impacts as compared to the Proposed Action or Alternative A (see Table 4.76). The shift in soil percentages would also result in a greater percentage of disturbances to soils with high wind and water erosion potential relative to other action alternatives, and a smaller percentage of disturbances to droughty soils (see Table 4.78 and Table 4.79). Long-term impacts to soils would also occur from the application of approximately 20,350 pounds of herbicide annually in the solar field, which is 45% less herbicide used than under the Proposed Action. All other impacts to soil resources under Sub-alternative A1 would be the same as under the Proposed Action and Alternative A.

4.13.6 Alternative B: Reduced Footprint

Under Alternative B, a total of 2,363.3 acres of soils would undergo long-term disturbance from the operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 1,225.4 acres). Long-term impacts to soils under Alternative B would occur from the application of approximately 24,050 pounds of herbicide annually in the solar field, which is 35% less herbicide used than under the Proposed Action. Short-term disturbance would occur on 30.2 acres, compared to 31.0 acres under the Proposed Action. This reduction would yield a minor change in the relative percentage of long-term impact to soil types; the Dateland-Cuerda Complex would have a slightly greater percentage of impact as compared to the Proposed Action or Alternative A, whereas the Gunsight-Rillito-Carrizo would have a slightly lower percentage of impact, as compared to the Proposed Action or Alternative A (see Table 4.76). The shift in soil percentages would also result in a greater percentage of disturbances to soils with high wind and water erosion potential relative to other action alternatives; although no disturbance would occur in droughty soils during short-term construction activities (see Table 4.78 and Table 4.79). All other impacts to soil resources under Alternative B would be the same as under the Proposed Action and Alternative A.

4.13.7 Reduced Water Use Option–Brine Concentrator

A brine concentrator could be implemented for either the Proposed Action or Alternative B to provide additional water savings to the SSEP. Utilization of the brine concentrator would not affect the total project footprint or the total acreages of disturbed soils. Consequently, the effects of this alternative on soil resources in the Project Area would be the same as previously described for each alternative. No additional impacts to soils were identified for this option during the analysis.

4.13.8 Generation Tie Line Option

The Gen-tie Line Option could be added to the Proposed Action, Alternative A, Sub-alternative A1, or Alternative B in place of the proposed gen-tie line alignment. Impacts to one soil type, the Denure-Rillito-Why complex, would occur if the Gen-tie Line Option were implemented. These additional impacts would consist of an 8.3-acre increase in disturbance in this soil type if the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B. If the Gen-tie Line Option were added to Sub-alternative A1, impacts would consist of an 11.4-acre increase in disturbance to the Denure-Rillito-Why complex (Table 4.80). Increased surface disturbance in the Denure-Rillito-Why complex would be less than 1% for all action alternatives if the Gen-tie Line Option were selected. No other soil type would be impacted by the implementation of this option in combination with any action alternative.

Table 4.80 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Soil Type	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Denure-Rillito-Why complex, 1 to 5 % slopes		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total Disturbance	**8.3**	**11.4**

If the Gen-tie Line Option were applied to the Proposed Action, Alternative A, or Alternative B in place of the proposed gen-tie line alignment, an additional 5.1 acres of temporary disturbance and 3.3 acres of long-term disturbance would occur in soils that are "moderately restrictive" for alkalinity (Table 4.81). If

the Gen-tie Line Option were applied to Sub-alternative A1, an additional 6.8 acres of temporary disturbance and 4.6 acres of long-term disturbance would occur in soils that are "moderately restrictive" for alkalinity. Increased surface disturbance in soils that are "moderately restrictive" for alkalinity would be less than 1% for all action alternatives if the Gen-tie Line Option were selected. No disturbance would occur in soils with a "moderately restrictive" or "highly restrictive" rating for water erosion hazard, wind erosion hazard, salinity, excess sodium, rooting depth, or droughtiness if this option were implemented with any of the action alternatives.

Table 4.81 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Restrictive Feature	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Alkalinity – Moderately restrictive		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total Disturbance	**8.3**	**11.4**

4.13.9 Potential Mitigation Measures

In addition to the applicant-committed environmental protection measures described in Chapter 2 and the Proposed Action, the following potential mitigation measures could be applied to reduce long-term impacts to soils:

- The applicant would prepare an approved herbicide use plan, or combine it with an integrated vegetation management plan, to ensure that all herbicides are safely applied at the minimum necessary level and that all products used are applied at a rate to minimize adverse impacts. This plan would be incorporated into the POD.
- In areas where some vegetation cover is acceptable from an operational standpoint, herbicides would be applied directly to target noxious weeds and invasive plant species.
- To the degree practicable, the use of herbicides that negatively affect BSC organisms (i.e., those that target photosynthetic structures and functioning versus targeting roots and aboveground structures) would be avoided.
- Herbicides would be applied only to target vegetation and not across the entire soil surface; this would allow BSC organisms to develop on graded areas and enhance soil stabilization following disturbance.

4.13.10 Residual Impacts

The potential mitigation measures listed above would minimize impacts from herbicide use, which is required for operation of the solar field throughout the life of the project. These potential mitigation measures would promote the recovery of soil organisms and BSC structure, and thereby facilitate the recovery of vegetation communities and functioning during the reclamation and restoration period. However, there would still be impacts to soil organisms and BSCs from herbicide use that is required to maintain operation of the solar field, or from herbicides that are inadvertently applied to the soil surface where target plant species are treated.

4.13.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would result in short-term and long-term impacts that would affect the long-term productivity of soils. During construction and operation, vegetation would be removed and would continue to be cleared in the Project Area. This would result in increased erosion and compaction and the loss of long-term soil productivity needed to support vegetation required to support other land uses (grazing, wildlife habitat, and the setting for dispersed recreation uses) for the life of the project. Following termination and restoration of the Project Area, it is possible that soils in these reclamation-restricted areas would experience some continued loss of productivity due to the difficulty in restoring vegetation.

4.13.12 Irreversible and Irretrievable Commitments of Resources

Construction and operation of the SSEP would result in short-term and long-term changes to soil productivity due to surface disturbance, clearing of vegetation, and the loss of the structure and functioning of BSCs from the use of herbicides. This loss of soil productivity would be irretrievable for the life of the project (30 years) and until restoration is complete. In some areas, soils would restrict rehabilitation success due to compaction, loss of biologically active soil layers, or loss of BSCs. It is possible that soil in these areas would experience some irreversible impacts due to the difficulty in restoring vegetation and BSCs.

4.14 Special Designations

4.14.1 Analysis Area and Analysis Assumptions

This section outlines the impacts to special designation areas from the implementation of the Proposed Action and alternatives. Three special designation areas are considered in this analysis: 1) the North Maricopa Mountains Wilderness, 2) Sierra Estrella Wilderness, and 3) the Sonoran Desert National Monument. The Sonoran Desert National Monument is managed to protect biological, archaeological, and historical resources (66 *Federal Register* 7354–7358). The wilderness areas are managed to maintain or enhance the natural character and vegetation communities, to provide opportunities for primitive recreation and solitude, and to provide habitat for a diversity of fauna (BLM 1995).

These three areas lie outside of the Project Area; however, they would be subject to indirect impacts from changes to the viewshed, increases in ambient sound levels, changes in access, and impacts to wildlife from activities associated with construction and operation of the SSEP. Impacts from noise are evaluated in terms of whether they would increase the ambient noise environment and thus have the potential to affect a visitor's recreation experience. An increase of 1–2 dBA is considered a nonperceptible change. An increase of 3 dBA may or may not be distinguishable in an outdoor environment. A 5-dBA or greater increase is described as a perceptible change and is clearly discernible (ASHRAE 1989). This analysis assumes that a certain portion of visitors to recreational and wilderness areas are seeking opportunities for quiet and that any noise level increase of 5 dBA or greater would perceptibly reduce quietness. It should be noted that 40 dBA gives the subjective impression of "quiet" (Beranek 1988).

Impacts to the recreation are evaluated in terms of whether there would be a change in opportunities for solitude and primitive recreation, a change in the ability of the visitor to access the wilderness or Sonoran Desert National Monument, a change to the current vegetation communities, and changes to the natural or undeveloped character of the landscape. To assess these changes, this analysis uses information from the noise, wildlife, and visual sections of this chapter. As described in Chapter 3, the analysis area for special designations is not a defined polygon but rather any topographic point within the wilderness areas or Sonoran Desert National Monument where sights or sounds from the Project Area may be experienced by a visitor.

4.14.2 No Action

Under the No Action alternative, the SSEP would not be developed, and the existing dispersed/primitive recreation and livestock grazing uses in the special designation areas would continue. The landscape and existing roads and trails surrounding the Project Area would not be altered, and no changes to the viewshed or soundscape would occur. There would be no new barriers to wildlife movement or increases in vehicle traffic. Therefore, there would be no changes to the wildlife or their habitat, vegetation communities, the landscape, or recreational experiences under this alternative.

4.14.3 Proposed Action

Under the Proposed Action, approximately 3,620 acres would be graded to accommodate the project components and fenced for safety and security purposes. Conversion of the natural setting to a high-contrast industrial facility would have long-term adverse impacts to recreation opportunities and users in special designation areas. The SSEP would introduce a large (approximately 3,620-acre) facility to the landscape. There would be no change to the recreational setting in any of the special designation areas; however, the presence (views) of this facility would degrade the primitive experience that some visitors

seek when visiting the nearby monument and wilderness. These changes would not be visible from all locations, and would be most apparent from locations close to the Project Area and from peaks with expansive vistas. According to the visual analysis section of Chapter 4, the project footprint would be visible from all three special designation areas. However, because the western tip of the Sierra Estrella Wilderness is 10 miles to the east of the eastern boundary of the proposed SSEP, this distance would reduce the effects on the view, and it is expected that the project facility would not stand out from the existing development in the area. Topography would also mitigate or eliminate (block) these effects in portions of the adjacent and nearby wilderness areas. Please see the visual simulation description of the view from KOP 18 in Section 3.17 and Map 21. From the higher elevations or peaks of the North Maricopa Mountains Wilderness, visitors would have superior or unobstructed views of the entire SSEP. Based on the visual simulation from KOP 1, the solar fields and vertical structures associated with the SSEP would be visible from the North Maricopa Mountains Wilderness. Similarly, visual simulations from KOP 2, KOP 6, and KOP 19 indicate that the Project Area would also be visible from the higher elevations and peaks of the Sonoran Desert National Monument. The transmission line and structures associated with the power block would be visible, as would the solar field. The reflexive color contrast would be strong throughout the day. This would have an adverse impact on the recreation setting and experience because it would alter the view of the 3,620 acres of the Project Area from a natural setting to an industrial setting. However, the entire viewshed from the mountains already includes residential areas, industrial sites, and utility corridors. The conversion of the SSEP site from open desert to a fenced industrial facility and the removal of vegetation would also have long-term adverse impacts to wildlife because it would reduce the amount of forage and habitat that would be accessible for species that travel from the special designation areas to the Project Area (see Section 4.19). There would be no impacts to the habitat or forage in the special designation areas.

The construction and operation of the SSEP would create noise. As described in the noise section of Chapter 4, the increase in noise levels at the North Maricopa Mountains Wilderness (Receptor ST-3) from ambient to construction noise levels would be approximately 12.0 dBA (Table 4.82). Noise levels during operations would not exceed ambient conditions at this same receptor. At the Sonoran Desert National Monument (Receptor LT-3) noise levels would increase no more than approximately 4.0 dBA above the ambient conditions during construction and would drop below ambient conditions during operations. With an increase of 12 dBA, noise levels would reach a maximum of 44 dBA during construction. The effect of this increase in noise on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. It is not expected that a visitor would hear the noise from the project facility in the Sierra Estrella Wilderness due to the distance between the two (10 miles). All noise from the operation and construction of the SSEP would dissipate within 1.75 miles of the source[11] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions.

[11] Noise attenuation to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA).

Table 4.82 Ambient, Construction, and Operational Noise Levels at Select Noise Receptors

Name/Location of Receptor	Ambient Noise Levels	Construction Noise Levels excluding Sub-alternative A1	Operational Noise Levels excluding Sub-alternative A1
ST-1/Prison frontage	62.7	38	16
ST-3/NMMW	28.2	40	21
LT-2/Baseline Road	46.4	43	26
LT-3/SDNM	39.7	44	27
BHRP	No ambient data	39	19
RBWA	No ambient data	37	11

Notes:
RBWA = Robbins Butte Wildlife Area (to NW of Project Area).
BHRP = Buckeye Hills Regional Park (to WNW of Project Area).

Construction of new roads and improvements to existing roads under the Proposed Action would cause short-term and long-term impacts to wildlife moving between the special designation areas and the Project Area because the roads would create a barrier to wildlife movement. There would be no impacts to wildlife movements within the special designation areas from the Proposed Action.

Under the Proposed Action, there would be an increase of 1,000 vehicles per day during the construction and 82 vehicles per day during the operations of the SSEP. Traffic would come primarily from SR-85 and would travel along the new access road to the project site. This increase in traffic would cause short-term adverse impacts to wildlife because of an increased risk of vehicle strikes and barriers to movement. Traffic would increase the risk of wildlife mortality and fragment populations. There would also be long-term adverse impacts from an increased risk of vehicle strikes during operations; however, traffic would be reduced by a factor of ten as compared to the construction period. There would also be adverse impacts to the recreational setting and experience due to the increase in the traffic volume, creating slower commute times while accessing the special designation areas.

4.14.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts under Alternative A would be the same as under the Proposed Action because approximately 3,609 acres (a difference of 11 acres compared to the Proposed Action) would be fenced and converted from open desert to an industrial facility to accommodate the project facility and components. The project footprint would still be visible from the special designation areas, and increases in vehicle traffic would still occur. This would have adverse impacts to the scenic quality of the landscape, recreation opportunities, and to wildlife, as discussed under the Proposed Action.

4.14.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, there would be approximately 1,607 acres (45%) less vegetation removed for the project footprint than under the Proposed Action. Therefore, the project facility would present less of a landscape change and less of an adverse impact to visitors in the special designation areas than under the Proposed Action. Sub-alternative A1 would be significantly less reflective because PV panel surfaces are designed specifically not to reflect light, thus reducing the potential for glint and glare. In addition, the PV panels of this alternative would have a lower profile than the solar troughs of the Proposed Action (approximately 20 feet tall), which would reduce visibility when viewed from level viewing positions. Overall, Sub-alternative A1 would minimize the potential for visual impacts to special designations because of the less reflective panel surfaces, smaller structures, and reduced project footprint. The number

of vehicle trips during peak construction and regular operations would be reduced by 733 trips (73%), but there would be no differences in access between Sub-alternative A1 and the Proposed Action. All other impacts to special designations under Sub-alternative A1 would be the same as under the Proposed Action.

Noise from construction of the SSEP under this sub-alternative at the noise receptors near or within recreation areas would be roughly comparable to the predictions for the Proposed Action. For the Proposed Action, there are instances of noise levels in the low to mid-40 dBA for construction. Under Sub-alternative A1, noise levels would not go above 46 dBA. As visitors venture deeper into the special designation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Operational noise levels under this alternative would not exceed ambient conditions; therefore, there would be no effects to the recreational experience during operations.

4.14.6 Alternative B: Reduced Footprint

Under Alternative B, there would be 1,226 acres (34%) less vegetation removed for the project footprint than under the Proposed Action. Therefore the project facility would present less of a landscape change and less of an adverse impact to visitors in the special designation areas. All other impacts to special designations under Alternative B would be the same as under the Proposed Action.

4.14.7 Reduced Water Use Option–Brine Concentrator

Impacts to special designation areas under this option would be the same as under the Proposed Action, because approximately 3,609 acres (a difference of 11 acres compared to the Proposed Action) of the Project Area would be converted from a natural setting to an industrial site and increases in vehicular traffic would still occur. This would have adverse impacts to the scenic quality of the landscape, recreation opportunities, and to wildlife, as discussed under the Proposed Action.

4.14.8 Generation Tie Line Option

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance.

The Gen-tie Line Option would not impact noise levels from the construction and operation of the SSEP because it would not generate any new or additional sound. Also, traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation compared to the proposed gen-tie alignment.

4.14.9 Potential Mitigation Measures

To meet the objective of protecting the biological resources in the Sonoran Desert National Monument, potential mitigation measures could be implemented to protect wildlife from vehicle strikes and from loss of habitat connectivity. These measures are discussed in the wildlife section of Chapter 4. Additional measures to mitigate visual impacts can be found in Section 4.17 (Visual Resources).

4.14.10 Residual Impacts

Please see the residual impact section of Chapter 4 wildlife for a discussion of residual impacts. Noise and visual residual impacts are discussed in Sections 4.9 and 4.17.

4.14.11 Short-term Uses versus Long-term Productivity

Implementation of the SSEP would create short-term and long-term changes to the scenic quality of the landscape and would cause barriers to wildlife movement and loss of habitat. These impacts would have an indirect impact on the human uses in special designation areas because the sight of the solar facilities would alter the recreational setting and experience. Implementation of the SSEP would also create short-term changes to access during the construction period because of the increase in the number of vehicles traveling in the area.

4.14.12 Irreversible and Irretrievable Commitments of Resources

The proposal outlined in Chapter 2 includes reclamation of the facility and all disturbed areas after the 30-year life of the project. Because the area would be reclaimed, there would be no irreversible impacts associated with the Proposed Action or other alternatives. However, the project footprint could visibly persist from special designation areas for some period of time beyond the project completion until vegetation reestablishes. Even after reclamation efforts are complete, the composition of vegetation species in the recovery area could be different than the original vegetation community, and additional time would then be needed for the native vegetation community to reestablish. Ultimately, the native vegetation community would reestablish and would once again provide habitat and forage for wildlife. Thus, the effect of operation of the SSEP would be an irretrievable adverse impact on wildlife and recreation setting and experience in the adjacent special designation areas.

4.15 Transportation and Traffic

4.15.1 Analysis Area and Analysis Assumptions

The area of analysis for transportation and traffic consists of the Project Area and the access routes that would be used for the SSEP's construction and operation, as discussed in Chapter 3, Section 3.15.

The impacts analysis for transportation and traffic in the Project Area and the adjacent traffic interchanges (as described in Chapter 3) discusses changes to the LOS that would result from the Proposed Action and alternatives. LOS is a measure of the quality of service experienced by motorists on transportation infrastructure; it generally indicates the level of traffic congestion. LOS on divided highways (such as SR-85) reflects traffic flow conditions, average speed, and time spent following other vehicles. The impacts analysis also discusses 1) changes that would occur to the total miles of routes in the existing transportation system and the resulting impacts to transportation and traffic and 2) changes in access to the existing transportation and traffic network.

Based on ADOT guidelines, future PHFs for the SSEP were used, as found in the *ADOT Traffic Engineering Policies Guidelines and Procedures Section 240 Traffic Impact Analyses* (ADOT 2000). They are as follows:

- PHF = 0.80 for < 75 vph per lane
- PHF = 0.85 for 75–300 vph per lane
- PHF = 0.90 for > 300 vph per lane

Future peak hour represents how many vehicles (vph) are predicted to travel through the SR-85/Riggs Road intersection.

To assess the impacts of the SSEP on future traffic operations, traffic predictions are made for 2012 and 2015 (SouthWest Traffic Engineering [SWTE] 2009, 2011). Year 2012 represents the assumed peak construction year, whereas year 2015 is the expected build-out year.

Due to lack of detailed historic traffic data in the Project Area, a growth rate could not be calculated. In light of this, a 3% growth rate was used to estimate traffic growth in the Project Area. A 3% growth rate is lower than the normal 5% growth rate standard used by ADOT when conducting traffic impacts analysis due to the economic recession experienced in 2008 and 2009.

Potential impacts to future transportation and traffic are discussed in Section 4.20.4.13 (Transportation and Traffic).

4.15.2 No Action

Under the No Action alternative, the SSEP would not be developed, and the existing transportation and traffic patterns and infrastructure in and around the Project Area would continue. The existing traffic and transportation patterns and infrastructure are detailed in Chapter 3 and can be considered as having a LOS of B[12] or better with low traffic volume and little to no transportation infrastructure improvements.

[12] LOS B indicates a 10–15-second traffic delay (see Table 3.47, Section 3.15.3.2).

Under the No Action alternative, the following ongoing transportation and traffic actions and activities are assumed to continue:

- Limited dispersed recreation across the Project Area would continue. Motorized vehicle use would be limited to existing routes in the area.
- The existing routes (13.1 miles) in the Project Area (as designated by the *Lower Gila Amendment*, BLM 2005a), would remain open to motorized travel.
- The SR-85/Riggs Road intersection would continue with the existing vehicular traffic volumes as reported by ADOT and MCDOT (see Chapter 3, Section 3.15).
- Riggs Road would continue to service the same volume of traffic.
- The Komatke Road alignment and Haul Road would continue to service the same volume of existing vehicular traffic.

4.15.2.1 LEVEL OF SERVICE

LOS was calculated for each intersection in the area of analysis for 2012 and 2015 under the No Action alternative. The predicted LOS for the SR-85/Riggs Road intersection estimates (SWTE 2009) were analyzed by comparing the predicted LOS with the existing LOS outlined in Chapter 3. Tables 4.83 and 4.84 display the predicted LOS for the SR-85/Riggs Road intersection in 2012 (representative of short-term construction traffic) and in 2015 (representative of long-term operations traffic).

The SR-85/Riggs Road intersection is located west of the Project Area, and it would be the primary access point to the project during construction and operation. The analysis of the SR-85/Riggs Road intersection consists of three separate traffic situations: northbound on SR-85; southbound on SR-85, and the northbound SR-85 exit ramp (Figure 4.1).

Table 4.83 2012 Peak Hour Levels of Service – No Action and Proposed Action

Intersection	No Action Alternative				Proposed Action*			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	B	12.5	A	7.4
Eastbound through	B	11.9	B	11.2	F	>120	B	11.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9	F	>120	B	10.8
Westbound through	B	11.9	B	11.2	F	>120	B	11.2
Westbound approach	B	10.3	A	9.9	F	>120	B	10.8
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2	A	9.2	F	>120
Eastbound through	B	10.8	B	12.6	F	>120	B	12.6
Eastbound approach	B	10.8	A	0.0	F	>120	F	>120
Westbound through	B	10.6	B	13.3	B	10.6	B	14.5
Westbound through/right	A	9.3	B	10.3	A	9.3	F	>120
Westbound approach	A	9.4	B	10.5	A	9.4	F	>120
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.6	A	8.8	F	>120
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	F	>120	F	>120

Source: SWTE (2009).

* The 2012 LOS for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as the Proposed Action.

Table 4.84 2015 Peak Hour Levels of Service – No Action and Proposed Action

Intersection	No Action Alternative				Proposed Action*			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	7.5	A	7.5
Eastbound through	B	12.1	B	11.3	B	13.4	B	12.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.4	A	9.9	B	11.6	B	10.7
Westbound through	B	12.1	B	11.3	B	13.4	B	12.2
Westbound approach	B	10.4	A	9.9	B	11.6	B	10.7
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.3	A	9.5	B	10.9
Eastbound through	B	10.9	B	13.0	B	11.5	B	13.8
Eastbound approach	B	10.9	A	0.0	B	11.5	B	13.8
Westbound through	B	10.7	B	13.6	B	10.7	B	13.7
Westbound through/right	A	9.4	B	10.4	A	9.5	B	10.8
Westbound approach	A	9.5	B	10.7	A	9.6	B	11.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.7	A	9.1	A	9.0
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	A	9.7	A	9.4

Source: SWTE (2009).

* The 2015 LOS for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as the Proposed Action.

As illustrated in Tables 4.83 and 4.84, under the No Action alternative the Project Area intersections would continue to operate at an LOS B or better in 2012 and 2015. When compared to the existing SR-85/Riggs Road LOS, the predicted-LOS of SR-85/Riggs Road under the No Action alternative would be very similar. Therefore, the No Action alternative would not result in any impacts to the LOS for transportation and traffic.

4.15.2.2 TRANSPORTATION ROUTES

Using the compounded, yearly traffic growth rate in 2012 and 2015, weekday peak hour traffic volume estimates under the No Action alternative are shown in Figures 4.1 and 4.2, which illustrate an aerial view of the SR-85/Riggs Road intersection. Arrows represent the direction of traffic flow, and the numbers following the arrows represent the vph that each intersection would experience in 2012. This illustrating convention is used throughout this chapter on all weekday peak hour traffic volume figures.

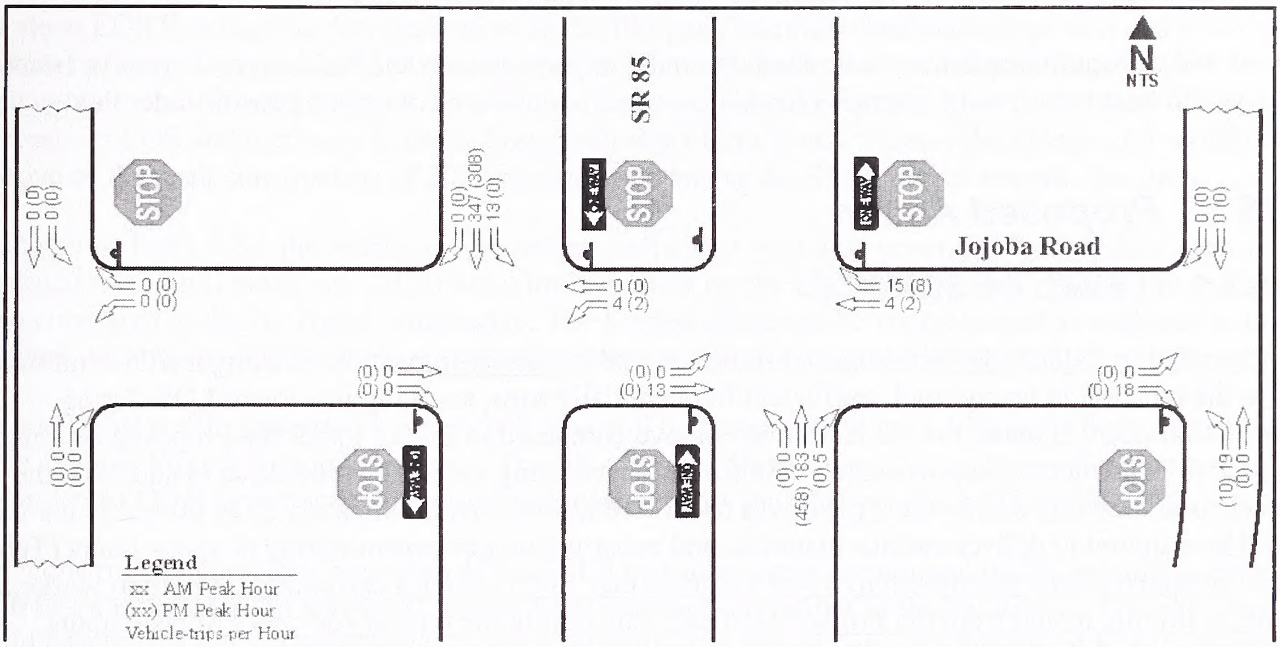

Figure 4.1 2012 weekday peak hour traffic volumes (SWTE 2009) – No Action alternative.
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

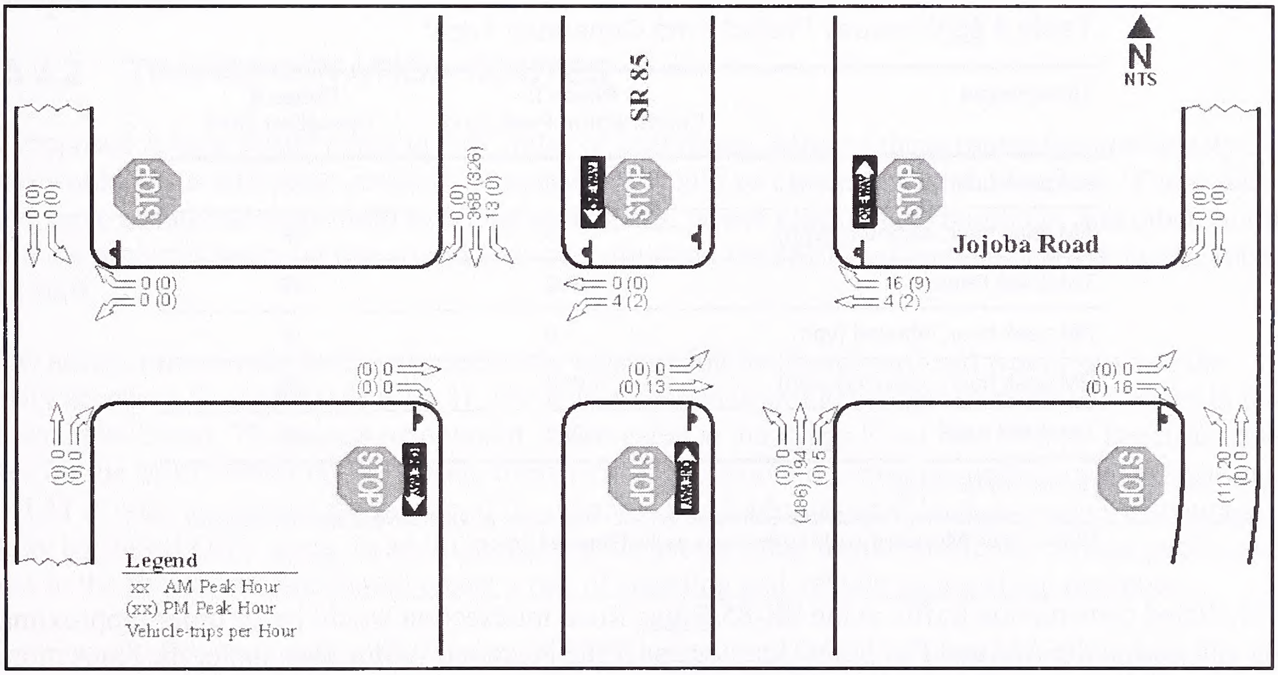

Figure 4.2 2015 weekday peak hour traffic volumes (SWTE 2009) – No Action alternative.
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

As Figures 4.1 and 4.2 illustrate, the No Action alternative would not increase traffic over the current volume at the SR-85/Riggs Road intersection.

4.15.2.3 CHANGES IN ACCESS AND INFRASTRUCTURE

Access and transportation infrastructure would not be impacted under the No Action alternative because there would be no new roads, upgrades to existing roads, or closures of existing roads under this alternative.

4.15.3 Proposed Action

4.15.3.1 LEVEL OF SERVICE

As illustrated in Table 4.83, the Proposed Action would adversely impact the existing traffic conditions due to the increase in heavy truck traffic and frequent daily trips, resulting in a lower LOS during construction (LOS B under the No Action alternative compared to LOS F under the Proposed Action). At the peak of construction, approximately 1,000 vehicles carrying workers would drive to and from the Project Area each day during the typical AM to PM work hours. Approximately 30 to 60 trucks per day would be required to deliver various materials and construction equipment during nonpeak hours (Table 4.85). To analyze peak construction, it was assumed that 1,000 vehicles carrying construction workers would be driving to and from the Project Area each day during the typical AM and PM peak hours. Although most of the workers would be expected to arrive and depart during these peak hours, specialty workers would be expected to arrive on-site during nonpeak hours.

Table 4.85 Weekday Project Area Generated Trips*

Time Period	Phase I: Construction Peak 2012	Phase II: Operation 2014
AM peak hour, inbound (vph)	1,000	28
AM peak hour, outbound (vph)	0	18
Total AM Peak	**1,000**	**46**
PM peak hour, inbound (vph)	0	18
PM peak hour, outbound (vph)	1,000	28
Total PM peak	**1,000**	**46**

Source: SWTE (2009).

**Note*: The Weekday Project Area Generated Trips for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as the Proposed Action.

The predicted construction traffic at the SR-85/Riggs Road intersection would be 10 times (approximately 1,000 vph during the AM and PM peaks) greater under the Proposed Action than under the No Action alternative. This increase in vehicle traffic would temporarily decrease the LOS from LOS B or better to LOS B or worse, with several areas expected to be LOS F for the SR-85/Riggs Road intersection during construction (see Table 4.83).

Under the Proposed Action, the intersection of SR-85 southbound mainline/Riggs Road is predicted to operate at an average of LOS F for the eastbound and westbound movements in the AM peak hour. These delays would be caused by the large, southbound left-turn movement, caused primarily by vehicles headed to the construction site. This would adversely impact traffic travelling north on SR-85 by increasing the likelihood of vehicle collisions with left-turning vehicles and northbound traffic on SR-85, and by slowing the speed that vehicles travelling north can achieve due to the required stop at the SR-85/Riggs Road intersection, which would result in longer travel times for vehicles.

The eastbound movements at the intersection of SR-85 northbound mainline/Riggs Road are predicted to operate at LOS F during the AM peak hour. In the PM peak hour the westbound approach and eastbound left-turn movement are predicted to operate at LOS F as well. Delays at this intersection are also attributable to the AM and PM peak hour flow of construction traffic to and from the Project. These decreases in LOS and increases in travel time (both short-term, construction-related impacts) would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation.

As shown in Table 4.84, the additional operations traffic that would be generated by the SSEP after peak construction and full build-out (2015) has a limited effect on the LOS at the existing project intersections when compared to the No Action alternative. The limited effect can be characterized as such due to the expected delay increases not being substantial enough to warrant a change in the LOS.

The additional traffic generated by the SSEP after full build-out would have a limited effect on the LOS of the existing Project Area intersections. The SR-85/Riggs Road intersections are predicted to continue operating at LOS B or better during the weekday peak hours with full project build-out in 2015.

With construction complete, operation of the SSEP and subsequent operational traffic would continue to result in a similar LOS for the SR-85/Riggs Road intersection, similar to the No Action. Travel times would return back to their existing levels after full build-out is complete (2014). During SSEP operation delay concerns with the increased left turning during construction would return back to the existing levels. Therefore, there would not be any long-term impacts to LOS on the SR-85/Riggs Road intersection under the Proposed Action.

4.15.3.2 TRANSPORTATION ROUTES

The Proposed Action would result in 6.61 miles of new routes. Most of these routes (approximately 3.5 miles) would occur within the project's footprint and would be closed to unauthorized use. These routes would serve as internal roads used to access solar fields, power blocks, staff buildings, and other facilities within the project's footprint and would only be authorized for SSEP staff and authorized guests, such as BLM staff.

A new access route would be constructed at the existing Jojoba Switchyard and would serve as the primary access to the SSEP (see Map 2). The new access road would be approximately 2.3 miles in length and would be paved. The access road would not be gated at the Riggs Road intersection. Because access routes for the SSEP would not be fenced, these new routes would increase the enforcement obligations of the BLM in order to prevent illegal use of the adjacent BLM-administered land, as well as discourage parking by illegal OHV users. In addition, paving the access route would enable the curious public easy access to the project site and would create a risk of speeding and vehicle racing along the route.

Approximately five spur roads off of the main SSEP access road would be constructed to access the gen-tie line towers, totaling less than 0.5 mile of new routes. Each spur road would lead to a construction pad and a pole structure. As with the primary access road, these new routes would increase the enforcement obligations of the BLM in order to prevent illegal use of the adjacent BLM-administered land. This would be a long-term impact, because the need for additional enforcement would persist for the life of the project.

Finally, a new route would be created along the proposed water pipeline route from Riggs Road to the project well field, resulting in approximately 0.85 mile of new, paved routes. This route would be closed to unauthorized use, but no gate would be installed. The addition of the well field access road would create a new route open to the public. However, because the new road would not be used to access existing transportation infrastructure (it would only access the proposed well field), existing traffic would not be impacted (refer to Section 4.7 for impacts to land use and access).

In addition to new routes, the existing Riggs Road east of the Project Area would serve as emergency access to the Project Area. The Riggs Road alignment is a BLM-authorized road ROW and is maintained by MCDOT. It would continue to be maintained or upgraded (if needed) and provide continued access to adjacent public lands. There is the potential for increased traffic on Riggs Road if construction workers use Riggs Road to the east of the Project Area for access rather than the primary SR-85 access to the west. However, this would be unauthorized use because the primary access is from SR-85 to the west. Additionally, local populations and persons driving for pleasure could also use Riggs Road to access, though not enter, the Project Area. A potential mitigation measure for this impact is included in Section 4.15.9.4. The remaining upgraded routes included in the Proposed Action would occur on the project access road that would use both the existing alignment of the Haul Road and Riggs Road immediately east of the SR-85/Riggs Road intersection. Approximately 1 mile of the Haul Road would be upgraded north of the Komatke Road/Haul Road intersection. Users would likely not traverse a rough road to access a short section of the upgraded Haul Road because other paved routes in the area offer the same experience. Approximately 0.80 mile of Riggs Road would be upgraded just east of the SR-85/Riggs Road intersection, within sight of SR-85. The ease of access to view the open desert and Sonoran Desert National Monument from this major route would increase the likelihood of driving for pleasure and/or casual exploration.

Road damage to existing roadways is not anticipated to occur because the roads used are adequately constructed to handle the types of loads required for construction and operation; however, any unintended damages or temporary improvements would be returned to their existing condition once construction is complete, as described in the Table 2.2 (Applicant-committed Environmental Protection Measures). Upgrades to the existing road system are not anticipated, not including the roads within the Project Area and the new access road.

4.15.3.3 CHANGES IN ACCESS

Under the Proposed Action, approximately 3,500 acres would be occupied by project components and would be fenced for safety and security purposes. This would eliminate 7.4 miles of routes within the project's footprint. These routes are available for recreational use; therefore, access for motorized and nonmotorized recreation uses would be lost across the Project Area. The fencing off of the Project Area would eliminate the BLM law-enforcement needs in this area. However, access to adjacent public lands would continue via other public lands and routes around the Project Area. It is not possible to predict the conditions that would exist at the time of the project's decommissioning. Therefore, decommissioning details would be developed and provided to BLM when the time for permanent closure is closer and more information is available. BLM would require the proponent to submit an abandonment plan that would be reviewed and approved by BLM. This plan would address transportation and traffic issues, and the BLM would determine whether to re-authorize the two BLM routes at the time of decommissioning.

The SR-85 northbound ramps/Riggs Road intersection is predicted to operate at an inadequate LOS F for the eastbound movements during the AM and PM peak hours. The intersection may also break down during the PM peak hour for the eastbound left and westbound movements. At this intersection, the delays would be associated with the construction traffic but also with the stop sign for eastbound traffic, which would stop major traffic movement. The impact on this intersection would be reduced by converting the eastbound stop sign to a north-south stop control intersection, which is included as a design feature of all action alternatives. Once project construction traffic begins flowing through the intersection, the east-west movement would be the major movement and would not be stop controlled.

Table 4.86 shows the design strategy described above and the corresponding LOS it would provide at the intersection of SR-85 northbound ramps/Riggs Road. The two columns on the right of the table represent the 2012 and 2015 expected delays, respectively.

Table 4.86 SR-85/Riggs Road intersection LOS

Intersection	Improvement	Without Stop Sign (2012)		With Stop Sign (2012)		With Stop Sign (2015)	
		AM Peak		AM Peak		PM Peak	
		LOS	Delay*	LOS	Delay	LOS	Delay
SR-85 Northbound Ramps/Riggs Road							
Northbound left/through/right	Change intersection to northbound/southbound stop control.	A	7.5	D	25.1	C	23.7
Southbound left/through/right		A	7.4	A	0.0	A	0.0
Westbound left/through/right		A	0.0	B	11.7	A	7.4
Eastbound left		A	8.8	A	7.2	B	10.7
Eastbound through/right		F	>120	A	0.0	A	0.0
Eastbound approach		F	>120		n/a		n/a

Source: SWTE (2009).
Note: Illustrative of Project Stop-Sign Design Feature.
*Delay = seconds per vehicle

As shown in Table 4.86, when compared to the existing conditions in Table 3.48, the stop sign would enable the existing LOS to continue during construction (2012) and operation (2015), except during the AM and PM peak traffic period when there would be an LOS D and LOS C, respectively. Mitigation measures (see Section 4.15.9), including car and/or vanpools, would reduce the impact of the SSEP's increase to traffic and LOS.

Figure 4.3 shows the expected lane configurations and traffic control during the peak construction year 2012.

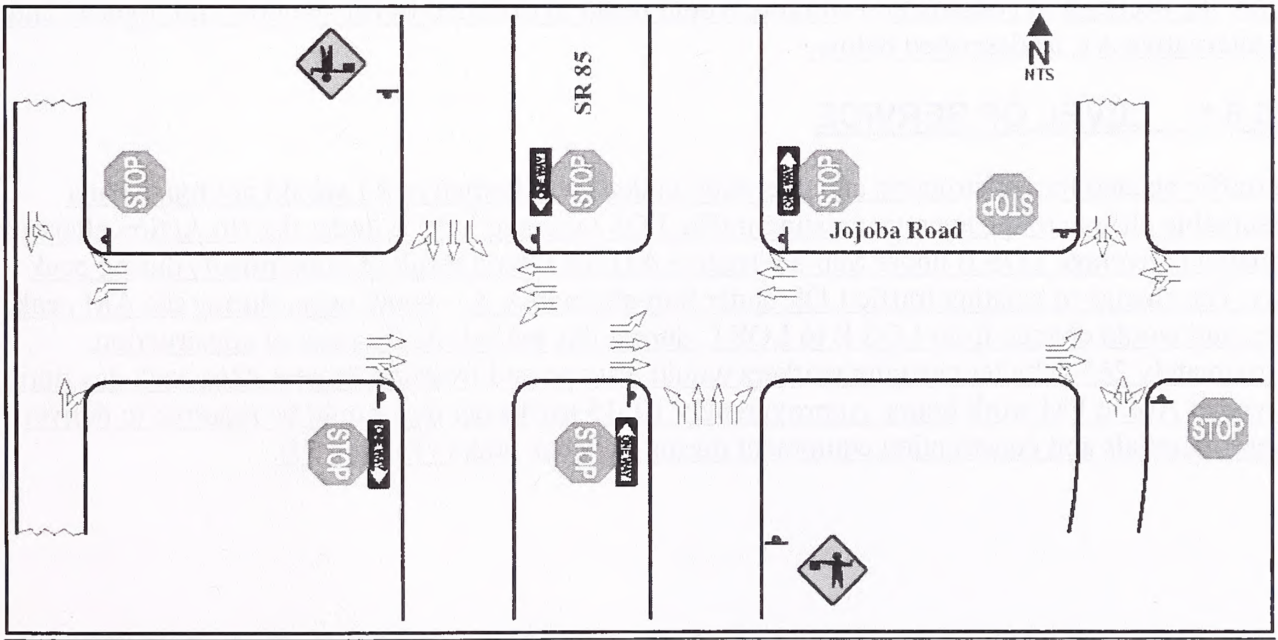

Figure 4.3 2012 construction peak/traffic control and lane configurations (SWTE 2009).
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

4.15.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, the SSEP would be constructed using a dry-cooling technology rather than the wet cooling considered under the Proposed Action. Impacts to transportation and traffic as a result of the implementation of Alternative A would be the same as under the Proposed Action. As such, only the differences in impacts to transportation and traffic between this alternative and the Proposed Action are described below.

4.15.4.1 LEVEL OF SERVICE

The project's construction schedule would be the same under Alternative A as under the Proposed Action. However, construction would require an average of 900 employees (instead of 870 under the Proposed Action) over the same 39-month period due to additional labor needs. This would equate to approximately 25 more worker vehicles per day than under the Proposed Action using SR-85 to access the Project Area. Despite the increase in worker vehicles per day, under Alternative A the LOS for the SR-85/Riggs Road intersection during construction (2012) and operation (2014) would be the same as under the Proposed Action.

4.15.4.2 TRANSPORTATION ROUTES

Impacts to transportation routes under Alternative A would be the same as under the Proposed Action.

4.15.4.3 CHANGES IN ACCESS

Impacts to changes in access under Alternative A would be the same as under the Proposed Action.

4.15.5 Sub-alternative A1: Photovoltaic

Sub-alternative A1 would use PV technology to generate electricity, resulting in a 51% smaller footprint, 20% reduction in generation, and a 77% decrease in construction workers compared to the Proposed Action. Although access roads and transportation corridors would be the same as under the Proposed Action, the decrease in construction workers would result in different traffic patterns and impacts under Sub-alternative A1, as described below.

4.15.5.1 LEVEL OF SERVICE

The traffic needed for construction and operation under Sub-alternative A1 would not represent a measureable change to the average existing traffic LOS (average LOS B under the No Action alternative compared to average LOS B under Sub-alternative A1) but would result in impairments during peak hours. The change to existing traffic LOS under Sub-alternative A1 would occur during the AM peak hours, and would change from LOS B to LOS C during this period. At the peak of construction, approximately 267 vehicles carrying workers would drive to and from the Project Area each day during the typical AM to PM work hours. Approximately 10–15 trucks per day would be required to deliver various materials and construction equipment during nonpeak hours (Table 4.87).

Table 4.87 Weekday Project Area–Generated Trips – Sub-alternative A1

Time Period	**Phase I: Construction Peak 2012**	**Phase II: Operation 2015**
AM peak hour, inbound (vph)	267	16
AM peak hour, outbound (vph)	0	0
Total AM Peak	**267**	**16**
PM peak hour, inbound (vph)	0	0
PM peak hour, outbound (vph)	267	16
Total PM peak	**267**	**16**

Source: SWTE (2011).

The increases in trips generated under Sub-alternative A1 would not change the existing LOS B at the SR-85/Riggs Road intersection during construction (Table 4.88) or operation (Table 4.89).

Table 4.88 2012 Peak Hour Levels of Service – No Action and Sub-alternative A1

Intersection	No Action Alternative				Sub-alternative A1: Photovoltaic			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	8.0	A	7.4
Eastbound through	B	11.9	B	11.2	C	22.8	B	11.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9	C	20.3	B	10.1
Westbound through	B	11.9	B	11.2	C	22.8	B	11.2
Westbound approach	B	10.3	A	9.9	C	20.3	B	10.1
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2	A	9.2	B	14.3
Eastbound through	B	10.8	B	12.6	C	16.3	B	12.6
Eastbound approach	B	10.8	A	10.2	C	16.3	B	14.3
Westbound through	B	10.6	B	13.3	B	10.6	B	13.6
Westbound through/right	A	9.3	B	10.3	A	9.3	B	14.1
Westbound approach	A	9.4	B	10.6	A	9.4	B	14.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.6	A	8.8	B	11.6
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	B	12.7	A	0.0

Source: SWTE (2011).

Table 4.89 2015 Peak Hour Levels of Service – No Action and Sub-alternative A1

Intersection	No Action Alternative				Sub-alternative A1: Photovoltaic			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	7.5	A	7.5
Eastbound through	B	12.2	B	11.3	B	12.6	B	12.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.5	A	10.0	B	10.9	A	10.0
Westbound through	B	12.2	B	11.4	B	12.6	B	11.4
Westbound approach	B	10.5	A	10.0	B	10.9	B	10.0
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.4	A	9.3	B	10.6
Eastbound through	B	11.0	B	13.1	B	11.2	B	13.1
Eastbound approach	B	11.0	A	0.0	B	11.2	B	13.1
Westbound through	B	10.8	B	13.8	B	10.8	B	13.9
Westbound through/right	A	9.5	B	10.5	A	9.5	B	10.7
Westbound approach	A	9.6	B	10.7	A	9.6	B	11.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.7	A	7.2	A	7.2
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	8.7	A	7.2	A	7.2

Source: SWTE (2011).

As illustrated in Tables 4.88 and 4.89, under Sub-alternative A1, the Project Area intersections would continue to operate at an LOS C or better in 2012 and 2015. The only instance in which Sub-alternative A1 would result in a LOS below LOS B would be during the AM peak hours for eastbound through traffic at the SR-85 southbound mainline/Riggs Road intersection.

4.15.5.2 TRANSPORTATION ROUTES

The transportation routes in Sub-alternative A1 would be the same as under the Proposed Action.

Weekday peak hour traffic volume estimates under Sub-alternative A1 are shown in Figure 4.4, which illustrates an aerial view of the SR-85/Riggs Road intersection.

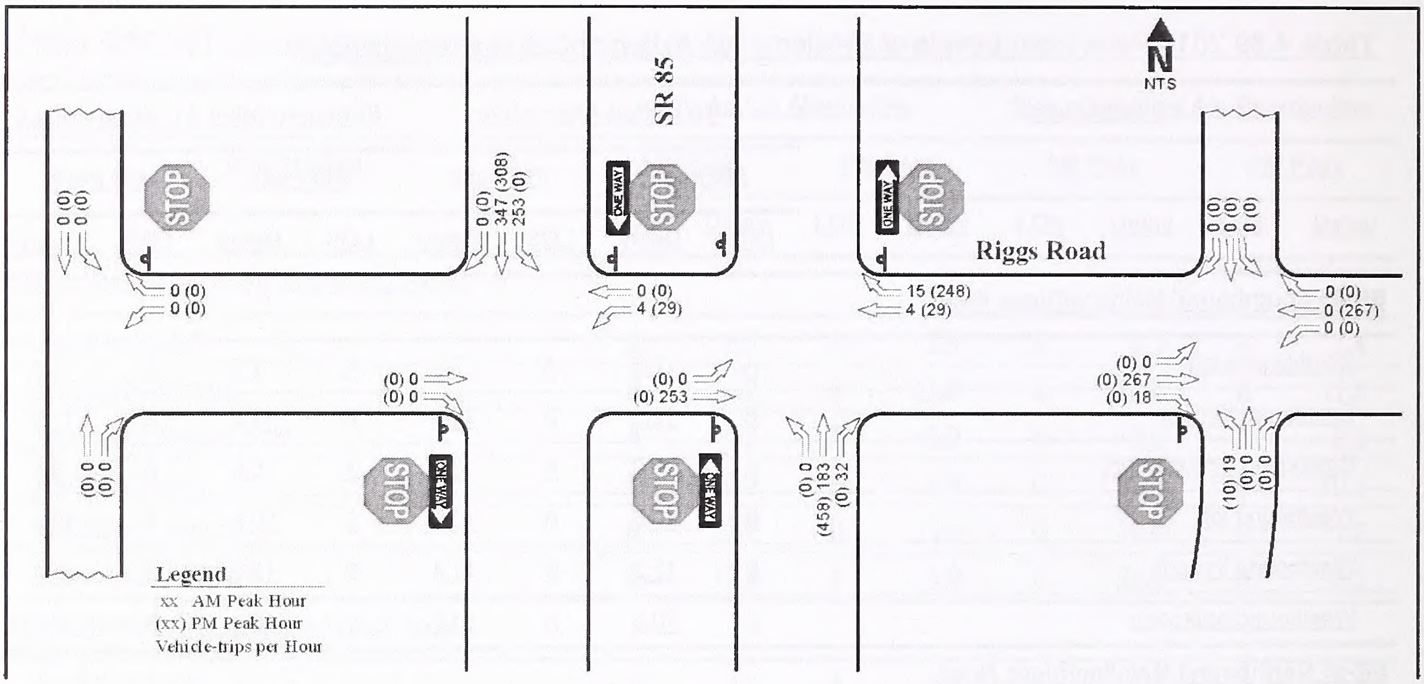

Figure 4.4 2015 weekday peak hour traffic volumes – Sub-alternative A1 (SWTE 2011).

As Figure 4.4 illustrates, the peak hour traffic volume would increase from the existing conditions described in Section 4.15.2.2 and on Figure 4.1. However, as described in Section 4.15.5.1, the LOS would continue at LOS C or better for all transportation routes under Sub-alternative A1 (traffic volume is not currently available for Riggs Road east of the Project Area).

4.15.5.3 CHANGES IN ACCESS

Changes in access under Sub-alternative A1 would be less than described under the Proposed Action because Sub-alternative A1 would require an approximately 50% smaller project footprint. Construction of the SSEP under Sub-alternative A1 would close approximately 3 miles of existing routes.

The stop sign design feature at the SR-85 northbound ramps/Riggs Road intersection would result in less adverse impacts than described under the Proposed Action because the number of trips would be less; however, the access patterns would be the same and the stop sign would have the same mitigating effect as described under the Proposed Action.

4.15.6 Alternative B: Reduced Footprint

In general, most impacts to traffic and transportation under Alternative B would be the same as under the Proposed Action. As such, only those subsections and details that would differ substantively from the Proposed Action are discussed below.

4.15.6.1 LEVEL OF SERVICE

Construction of each unit under Alternative B would take two months less than under the Proposed Action. This would result in a shorter duration of peak-construction traffic than under the Proposed Action. Thus, impacts to transportation and traffic, such as delay concerns at the SR-85/Riggs Road intersection, increased expected travel time, and decreases in the LOS at the SR-85/Riggs Road intersection would be the same as disclosed under the Proposed Action, but would persist for two months less time.

4.15.6.2 TRANSPORTATION ROUTES

Although the power plant footprint under Alternative B would occupy 34% less acreage than the Proposed Action, construction of the SSEP would close 3.7 miles of existing routes.

4.15.6.3 CHANGES IN ACCESS

Impacts to changes in access under Alternative B would be the same as under the Proposed Action, except fewer acres and fewer miles of existing routes would be affected.

4.15.7 Reduced Water Use Option–Brine Concentrator

Impacts to transportation and traffic (under any alternative) would not change with the application of this option.

4.15.8 Generation Tie Line Option

Impacts to transportation and traffic would not change with the application of this option to any of the action alternatives, because the implementation of the Gen-tie Line Option would require the same number of vehicle trips as the implementation of the proposed gen-tie line.

4.15.9 Potential Mitigation Measures

Under all action alternatives except Sub-alternatives A1, all three intersections in the analysis area are predicted to operate at an inadequate LOS F during the construction peak hours in 2012. Proposed mitigation measures or improvements to these intersections, which would help them operate more efficiently during project construction, are discussed below. In a traffic impacts analysis submitted to the ADOT, under all action alternatives except Sub-alternative A1, Boulevard has proposed prohibition of left turns by southbound traffic on SR-85 onto Riggs Road. Final approval by ADOT of an alternative mitigation measure for traffic is expected shortly after details of a lane closure are finalized.

4.15.9.1 INSTALLING SPEED BUMPS AND NO PARKING SIGNAGE ALONG THE NEW ACCESS ROAD

The new SSEP access road would not be gated. To decrease the impact of this new transportation route on public safety and OHV-use enforcement, following construction, Boulevard would install speed bumps every 500–1,000 feet along the access road and install "no parking" signage along the sides of the access road. The speed bumps would include standard dimensions as described in the Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Device* (FHWA 2009). These measures would effectively eliminate the risk of speeding and vehicle racing along the route, as well as discourage parking by illegal OHV users.

4.15.9.2 CONSTRUCTION WORKERS USING CARPOOL OR VANPOOLS

Table 4.85 discusses the anticipated number of vehicle trips required under all alternatives. To immediately reduce the number of vehicle trips under all alternatives, Boulevard would implement a mandatory (or fund) carpool or vanpool system. Workers travelling to the SSEP from proximate locations would be provided van transportation to the project site or be required to carpool to reduce the number of vehicles required for their transport. Although any carpool/vanpool system would be mandatory under this potential mitigation measure, the details of the system would be at the discretion of Boulevard, except that the carpool/vanpool system would be required to result in LOS C or better.

4.15.9.3 CONTRACTUALLY OBLIGATE CONSTRUCTION WORKERS TO USE SR-85/RIGGS ROAD INTERSECTION (WEST OF PROJECT AREA) AS THE ONLY ACCESS POINT TO SSEP

Riggs Road travels east-west to the south of the Project Area and is currently not paved. To prevent an unintended increase in traffic on the dirt road from construction workers accessing the SSEP from the east, Boulevard would contractually require all construction workers to access the SSEP from the west, using Riggs Road exclusively from SR-85. This mitigation measure would prevent increased fugitive dust and traffic patterns on the portion of Riggs Road east of the Project Area, except for limited use to access the well field and any unanticipated emergency use.

4.15.9.4 RESTORATION OF ALL PUBLIC ROADS, EASEMENTS, AND RIGHTS-OF-WAY

Boulevard would restore (or fund the restoration of) all public roads, easements, and ROWs damaged due to project-related construction activities to original or near-original condition in a timely manner, as directed by the BLM. Potential repairs and restoration of roads may be required at any time during the construction phase of the project to assure safe ingress and egress to all vehicles.

4.15.9.5 ACCELERATION LANES ON NORTHBOUND AND SOUTHBOUND SR-85 DURING CONSTRUCTION ONLY

In order to mitigate the LOS impacts associated with the Proposed Action, Alternative A, and Alternative B, an acceleration lane would be included on the south and northbound lanes of SR-85 during construction only. This would enable thru-traffic to continue travel along SR-85, while also enabling construction traffic to avoid the thru-lanes.

4.15.9.6 ADVANCE SIGNING ON SR-85 TO ALERT TRAVELERS OF CONSTRUCTION

In order to alert travelers on SR-85 both northbound and southbound, advance signage would be placed along SR-85, 1 mile south and north of the Riggs Road intersection. This would allow travelers to make lane changes, reduce speed, and allow safe distances and time for construction traffic that may be turning from southbound SR-85 onto Riggs Road. Contractors would follow the design standards mandated by the FHWA and adhere to the 2009 *Manual on Uniform Traffic Control Devices*.

4.15.9.7 INSTALLATION OF A LOCKED GATE AT THE WELL FIELD ACCESS ROAD ENTRANCE

To prohibit unwanted traffic on the well field access road, a gate would be installed at the entrance along Riggs Road.

4.15.10 Residual Impacts

If the potential mitigation measures above are implemented, several residual impacts would still occur. First, the installation of parking signs would decrease the likelihood of public parking along the new access road to access the public lands, but it would not eliminate it. Second, implementation of a vanpool system would decrease the traffic but would not eliminate it because certain heavy trucks and equipment would use a specific vehicle and could not be consolidated into a vanpool. The residual impacts to the LOS would depend on the alternative and the degree to which vanpooling were used. Therefore even with the mitigation measure of implementing a vanpool, traffic would still increase as a result of the project.

Project-related use of Riggs Road east of the well-access field is not anticipated because employees would be contractually obligated to use SR-85 for commuting to and from SSEP; however, emergency situations could result in project-related use of the portion of Riggs Road that travels east to Rainbow Valley Road to access the project.

Regardless of the alternative implemented, changes to the existing transportation network would result in residual transportation impacts because the routes that currently exist within the project footprint would be precluded by the project and unavailable for use. Depending on the selected alternative, the project would eliminate approximately 3.0–7.4 miles of existing roads.

Finally, there is a temporary risk to transportation and traffic if damage to existing roads is not immediately addressed by Boulevard or another entity.

4.15.11 Short-term Uses versus Long-term Productivity

The short-term use of the Project Area (the 30-year life of the project) would not have a long-term effect on the traffic and transportation system in the surrounding area once site decommissioning occurs. The primary long-term effect would be the loss of travel routes in the Project Area.

4.15.12 Irreversible and Irretrievable Commitments of Resources

Under all action alternatives, existing routes currently crossing the SSEP Project Area would be irretrievably eliminated due to the project's construction and operation. These routes would be lost until the project's lifespan has expired and until BLM has taken steps to reestablish them. Because the Project Area would be reclaimed following termination, there would be no irreversible impacts associated with the Proposed Action or other alternatives.

4.16 Vegetation and Special-status Plant Species

This section describes the impacts of the Proposed Action and alternatives, as described in Chapter 2, on vegetation communities, special-status plant species, and noxious and invasive plant species.

Four federal regulations pertain to plant species in and adjacent to the Project Area: 1) those plant species listed by the USFWS under the ESA; 2) those plant species listed as sensitive by the BLM under BLM Manual Section 6840; 3) EO 13112 of February 3, 1999–Invasive Species; and 4) the Plant Protection Act. In addition, there are two sets of Arizona State regulations pertinent to the plant species addressed in this section: 1) State of Arizona laws addressing the control and eradication of noxious weeds (A.A.C. §§ R3-4-244 and R3-4-245); and 2) Arizona Native Plant Law (§ R 3-3-1101 through R 3-3-1111; and A.R.S. § 3-901 through 3-916). These regulations are described in Chapter 3, Section 3.16.2.

4.16.1 Analysis Area and Analysis Assumptions

Vegetation communities and special-status plant species would be removed from the Project Area at the beginning of construction, and ongoing treatments would prevent recolonization. Noxious and invasive plant species would establish in perimeter areas from Project Area disturbances to existing seed banks or from the introduction of propagules into the site, but would be mitigated in the Project Area where chemical and mechanical treatments are used to prevent plant establishment for the life of the project.

Deposition of fugitive dust onto plant stems and leaves would reduce photosynthetic activity and overall plant health and productivity. Indirect negative impacts to vegetation adjacent to the Project Area and transportation corridors would occur on untreated roadways. These impacts would be proportional to the number of vehicle trips associated with project activities.

BSCs consist of blue and green algae, lichens, mosses, fungi, and bacteria that bind the surface of the soil (Belnap et al. 2001). BSCs are recognized as important features of desert ecosystems due to their ability to stabilize the soil, capture and retain atmospheric moisture and rainfall, facilitate seed germination, and increase nutrient availability for plant growth (Belnap et al. 2001). BSCs in the Sonoran Desert ecosystem occur as a flat layer on the surface of the soil (Belnap et al. 2001). The removal of this type of BSC allows water to flow unimpeded over the soil surface, which reduces moisture infiltration into the soil and increases soil erosion (Belnap et al. 2001). Because BSCs are a major component of vegetation communities in the Sonoran Desert (Belnap et al. 2001), there is reasonable expectation that BSCs occur in the Project Area – either intact or as remnants due to historic disturbances. All project-related surface disturbance that removes or damages BSCs would negatively impact vegetation communities by slowing vegetation establishment and growth. BSCs in desert ecosystems can require decades to centuries to recover, and the lack of these soil organisms may slow vegetation reestablishment following disturbance or removal by reducing soil stability and the availability of moisture and nutrients to growing plants (Belnap et al. 2001). Disturbance that removes soil crust organisms would result in slower recovery of BSC diversity and functioning than disturbance that leaves crushed crust material in place (Belnap et al. 2001).

4.16.1.1 VEGETATION COMMUNITIES

The analysis area for vegetation communities consists of the Project Area, which includes the project footprint, linear facilities, and transportation and access corridors. Acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash disturbance are used to quantify impacts to vegetation communities that result from implementation of the alternatives. The degree of impacts would depend on the extent (acres and linear feet) and duration (long-term versus temporary) of the disturbance. The rate at which vegetation recovers following restoration, and the effectiveness of restoration activities, would also determine the degree of long-term negative impacts to vegetation communities.

4.16.1.2 SPECIAL-STATUS PLANT SPECIES

The analysis area for special-status plant species consists of the Project Area, which includes the project footprint, linear facilities, and transportation and access corridors. Acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash disturbance are used to quantify impacts to special-status plant species based on the assumption that the number of individual special-status plants affected would be proportional to the number of acres or linear feet affected.

Under Arizona Native Plant Law (ADA 2009a, 2009b; see Section 4.1.1 above) no protected plant can be removed or transported without permission and a permit from the ADA. Implementation of any of the action alternatives would require notification of the ADA 60 days prior to removal of any protected native plant. In both long-term use and temporary use areas, surveys would be conducted to identify and tag native plant species protected under Arizona Native Plant Law, and individual plants would be removed in accordance with appropriate ADA salvage permits prior to land clearing. A list of the native plant species protected under ADA that are known to occur in the Project Area is given in Chapter 3, Section 3.16.4.1. The analysis of impacts assumes that all special-status plant species in the Project Area would be salvaged or destroyed. Because the Project Area is dominated by creosotebush and contains numerous other unprotected plant species, special-status plant species represent only a portion of the vegetation that would be removed.

4.16.1.3 NOXIOUS AND INVASIVE PLANT SPECIES

The analysis area for noxious and invasive plant species consists of the perimeter of the Project Area, including linear facilities and transportation corridors. This perimeter represents the interface between long-term and temporary surface disturbances and vegetation communities, which is where noxious and invasive plant species are most likely to become established and spread into adjacent habitats. There is currently no specific guidance for noxious and invasive plant species mitigation for the BLM LSFO. Because the rate of seed production and seed dispersal (and thereby, the likelihood of introduction) differs for each noxious and invasive plant species, it is difficult to define an area of any given size for impacts analysis. The length (feet) of the project perimeter is used to quantify impacts based on the assumption that the Project Area boundary would be the initial location of the introduction and subsequent spread of any noxious or invasive plant species. The Project Area perimeter would have increased susceptibility to the introduction or spread of noxious and invasive plant species for the following reasons: 1) direct surface disturbance from grading, road construction, road improvement, and maintenance activities could create favorable conditions for the germination and establishment of noxious and invasive plant species that prefer disturbed soils; 2) noxious and invasive plant species seeds, propagules such as root fragments or plantlets, and seed-contaminated soils could be transported into the Project Area on clothing, vehicles, construction equipment, and other materials; 3) any existing noxious and invasive plants could be spread within or out of the Project Area on clothing, vehicles, equipment, and other materials; and 4) dust control activities and equipment washing could inadvertently provide water to existing seed banks and promote the germination and establishment of noxious and invasive plant species. The perimeter of treated areas and any untreated developments associated with project activities would have increased potential for the introduction and spread of noxious and invasive plants. For purposes of analysis, it is assumed that negative impacts from the introduction and spread of noxious and invasive plant species would occur in untreated areas and would be proportional to the length of the project perimeter and to the number of vehicle trips associated with project activities.

Dense concentrations of noxious and invasive plant species contribute to fuel loading that does not normally occur in the Sonoran Desert ecosystem. The increased fuel loading results in increased frequency and intensity of fires. Invasion of noxious and invasive plant species into vegetation communities can also negatively impact BSCs, as weed species commonly invade and spread in the open space between native plants.

BSCs can be directly displaced by invasive plants, or indirectly impacted as a result of the hot ground fires that dense stands of invasive plants facilitate. These hot fires sterilize the soil and the increased fire frequency that results from ongoing fuel loading prevents recovery of BSCs and reduces their compositional diversity (Belnap et al. 2001). The frequent, large fires that are produced by invasive grasses and forbs in the Sonoran Desert ecosystem prohibit recolonization by BSC organisms (Belnap et al. 2001 and references therein).

4.16.1.4 APPLICABLE APPLICANT-COMMITTED MEASURES

The analysis of impacts to vegetation resources assumes that the following applicant-committed measures would be successfully implemented. All temporarily disturbed areas would be reclaimed to as close to pre-construction conditions as possible, as required by the BLM. Temporary access roads used during construction would be regraded and restored to pre-existing function and grade. BLM-approved seed mixes would be applied to temporarily disturbed areas, as required. No fertilizer would be used during stabilization or rehabilitation activities unless authorized by the BLM. When construction of stormwater management structures is complete, contours would be restored to the extent feasible. Applicant-committed dust suppression treatment of dirt roadways and in and around the solar field would be implemented to mitigate or minimize impacts to vegetation from fugitive dust. Impacts to vegetation communities from fugitive dust would be mitigated where dust suppression treatments are used.

Applicant-committed measures for the reclamation of long-term disturbance would consist of the following: structure foundations would be removed to 3 feet below ground surface, contours would be restored over the foundations to pre-project conditions, and stormwater management berms would be removed and restored the pre-project contours. All post-construction ROWs would be restored, as required by the BLM. All practical means would be made to restore the land to its original natural drainage patterns. Because revegetation would be difficult in many areas of the SSEP due to low precipitation in the Sonoran Desert, all practicable measures would be taken to minimize disturbance during construction.

The analysis of impacts to vegetation resources assumes that applicant-committed reclamation and restoration measures would be successful. However, the rate of vegetation recovery would depend on whether seeds, salvaged plants, or container stock are used, and whether seasonal precipitation is sufficient to promote plant establishment and growth (Bean et al. 2004). Other contributing factors to vegetation recovery are the degree of soil compaction (Kade and Warren 2002) and the rate of BSC recovery (Belnap et al. 2001). Recovery times to alleviate soil compaction and for the reestablishment of BSC organisms would be proportional to the length of the disturbance. Because of the variety of potential revegetation methods and fluctuating ecological conditions in the Sonoran Desert, recovery of vegetation structure and functioning would require from a minimum of five to ten years (Bean et al. 2004) to more than fifty years (Kade and Warren 2002, Guo 2004). Prolonged disturbance in arid ecosystems slows vegetation recovery times due to soil compaction and the loss of soil organisms that promote plant growth (Guo 2004).

The analysis of impacts presented here assumes that all applicant-committed measures described above and in Chapter 2 (see Table 2.2), and the regulatory requirements and required mitigation described in Section 4.1.1, would be successfully implemented.

4.16.2 Impacts to Vegetation Communities

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. The Xeroriparian Wash community contains generally the same plant species as the surrounding Sonoran Creosotebush-Bursage Scrub community, but plants occur at higher densities due to ephemeral water availability in the washes. For purposes of impacts analysis, impacts to vegetation communities are described as both acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash. The Xeroriparian Wash community is treated as a distinct vegetation community because higher densities of plants would be affected by proposed activities in the linear wash areas than in upland Sonoran Creosotebush-Bursage Scrub.

Long-term disturbance to vegetation communities would occur on most of the Project Area under all action alternatives due to the removal of all existing vegetation and ongoing treatment to prevent vegetation establishment for the life of the project. Temporary disturbances to existing vegetation would be limited to gas and water line ROWs and temporary work areas, gen-tie line access roads, and development of and improvements to transportation corridors. The removal of vegetation would have several indirect effects, including the loss of BSCs, increased potential for soil erosion (see Section 4.13), increased potential for the introduction and spread of noxious and invasive plant species (see Section 4.16.4 below), and reduced availability and/or quality of wildlife habitat (see Section 4.19).

4.16.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue. Management of vegetation would continue at the discretion of the BLM under the *Approved Amendment to the Lower Gila North Management Framework Plan and the Lower Gila South RPM and Decision Record* (BLM 2005). Livestock grazing in the Project Area would continue in two allotments, one of which is ephemeral and only grazed when infrequent (ephemeral) precipitation allows the production of adequate forage. Limited vehicle use of the Project Area, and associated impacts to vegetation communities from fugitive dust, would continue to occur as a result of vehicle use on existing routes in the Project Area. Limited recreational foot traffic would presumably also continue at low levels.

No acres of Sonoran Creosotebush-Bursage Scrub and associated linear feet of Xeroriparian Wash would be disturbed beyond any currently existing surface-disturbing activities (Tables 4.90 and 4.91).

Table 4.90 Acres of Disturbance to the Sonoran Creosotebush-Bursage Scrub Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	3,568.8	3,561.2	1,963.1	2,343.4
Temporary use	0	31.0	29.0	29.3	30.3
Total Disturbance	**0**	**3,599.8**	**3,590.2**	**1,992.4**	**2,373.7**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for the Proposed Action with brine concentrator option and Alternative B with the brine concentrator option.

Table 4.91 Linear Feet of Disturbance to Xeroriparian Wash Vegetation – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	38,347.0	38,295.7	22,237.0	21,939.8
Temporary use	0	197.8	182.4	223.9	182.4
Total Disturbance	**0**	**38,554.8**	**38,478.1**	**22,460.9**	**22,122.2**

Note: Linear feet of disturbance do not include existing road surfaces.

*Linear feet of disturbance would be the same for the Proposed Action with brine concentrator option and Alternative B with brine concentrator option.

Under the No Action alternative, several water supply test wells in the Project Area would be plugged and abandoned, and any associated site disturbance would be reclaimed. Reclamation of disturbed areas associated with the test wells would have long-term beneficial impacts on vegetation by restoring the structure and functioning of the vegetation community and by reducing the risk of invasion by noxious and invasive plant species by establishing native plant species.

4.16.2.2 PROPOSED ACTION

Vegetation communities would be disturbed by construction, operation, and maintenance activities that remove vegetation in either the long-term (life of the project) or the short-term (temporary, up to 5 years). The primary long-term and short-term impacts to vegetation communities would be from the removal of existing vegetation. Direct impacts to vegetation communities would result from the removal of 3,599.8 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 38,554.8 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would result from the removal of 3,568.8 acres of Sonoran Creosotebush-Bursage Scrub (including 38,347 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 31 acres of Sonoran Creosotebush-Bursage Scrub (including 197.8 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

The Proposed Action would result in an increased likelihood and amount of wind-borne fugitive dust, which would produce temporary and long-term indirect adverse impacts to vegetation within and adjacent to the Project Area. Wind-borne fugitive dust negatively impacts nearby vegetation by coating leaves and reducing photosynthetic activity and palatability to wildlife. A temporary increase in vehicle and construction equipment traffic into and within the Project Area would occur during project construction. Increased travel associated with day-to-day operations and maintenance activities would occur for the life of the project. Applicant-committed dust suppression treatment of dirt roadways and in and around the solar field would mitigate or minimize impacts to vegetation from fugitive dust that is produced by grading, development and travel on dirt roads. Indirect impacts to vegetation communities would also occur from fugitive dust that is produced by vehicle travel on paved roadways. The extent and degree of these impacts would depend on local climatic conditions and other factors that are difficult to quantify. However, for purposes of analysis we assume that negative impacts to vegetation functioning that result from fugitive dust would be proportional to the number of vehicle trips associated with project activities. At the peak of construction, approximately 1,000 vehicles would travel to and from the Project Area each day on paved roads. Approximately 46 vehicles would travel to and from the Project Area during regular operations.

Direct and indirect impacts to vegetation communities would be greater under the Proposed Action than under the No Action alternative.

As described in Sections 4.18.1.3.1 (Impacts to Surface Water Resources during Construction) and 4.18.1.3.5 (Impacts to Surface Water Resources during Operations), surface water flows in washes, uplands, and floodplains would be returned to pre-construction conditions and would likely match that of the surrounding landscape. Because of this, there would be no broad-scale mortality of vegetation due to disruptions in surface water flows, and no impacts from surface water flows to vegetation communities.

4.16.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, long-term impacts to vegetation communities from clearing of the project footprint would be the same as under the Proposed Action. The only difference in impacts to vegetation communities from construction and operation of the project would be a reduction in the number of groundwater well facilities from four wells to two and a reduction in access roads (see Map 5).

Direct impacts to vegetation communities would result from the removal of 3,590.2 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 38,478.1 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would result from the removal of 3,561.2 acres of Sonoran Creosotebush-Bursage Scrub (including 38,295.7 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 29 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 182.4 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

Under Alternative A, there would be a 0.3% (9.6 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 0.2% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action. All other impacts to vegetation resources would be the same under Alternative A as under the Proposed Action. Direct and indirect impacts to vegetation communities would be greater under Alternative A than under the No Action alternative, but would be less than under the Proposed Action.

4.16.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Long-term impacts to vegetation communities from clearing of the project footprint would be less than under the Proposed Action due to the smaller footprint of the SSEP under Sub-alternative A1.

Under Sub-alternative A1, direct impacts to vegetation communities would result from the removal of 1,992.4 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 22,460.9 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Of this total, long-term direct impacts would result from the removal of 1,963.1 acres of Sonoran Creosotebush-Bursage Scrub (including 22,237 linear feet of Xeroriparian Wash) in the primary project footprint and for the construction of groundwater well facilities and transportation corridors. For the remainder of the total disturbed acres, temporary direct impacts would result from the removal of 29.3 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 223.9 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of and improvements to transportation corridors. Under Sub-alternative A1, there would be a 45% (1,607.4 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 42% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action.

At the peak of construction, vehicle trips along roadways would be reduced by 733 trips (73%) per day to 267 trips, with an associated reduction in fugitive dust impacts to vegetation communities compared to the Proposed Action. Approximately 16 vehicles would travel to and from the Project Area during regular operations.

Overall, direct and indirect impacts to vegetation communities would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than under the Proposed Action.

4.16.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, long-term impacts to vegetation communities from clearing of vegetation in the project footprint would be reduced, and the number of groundwater well facilities and associated access roads would be reduced from four wells to three (see Map 6).

Direct impacts to vegetation communities would result from the removal of 2,373.7 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 22,122.2 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would results from the removal of 2,343.4 acres of Sonoran Creosotebush-Bursage Scrub (including 21,939.8 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 30.3 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 182.4 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

Under Alternative B, there would be a 34.1% (1,226.1 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 42.6% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action. At the peak of construction, vehicle trips along untreated paved roadways would be reduced by 50 trips (5%) per day to 950 trips, with an associated reduction in indirect impacts to vegetation communities from fugitive dust compared to the Proposed Action. Approximately 46 vehicles would travel to and from the Project Area during regular operations, or 12.5% fewer vehicle trips than under the Proposed Action. All other impacts to vegetation resources would be the same under Alternative B: Reduced Footprint as under the Proposed Action. Direct and indirect impacts to vegetation communities would be greater under Alternative B than under the No Action alternative, but would be less than under the Proposed Action or Alternative A.

4.16.2.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. The option would not change impacts to vegetation resources under either the Proposed Action or Alternative B because implementation of the option would not change the area of vegetation communities removed or disturbed.

4.16.2.7 GENERATION TIE LINE OPTION

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, temporary impacts to vegetation communities would result from the removal of 5.1 additional acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 32 linear feet of Xeroriparian Wash), when compared to the proposed gen-tie line alignment. Long-term impacts would result from the removal of 3.6 additional acres of Sonoran Creosotebush-Bursage Scrub (including 33 linear feet of Xeroriparian Wash). If the Gen-tie Line Option were added to Sub-alternative A1, temporary impacts to vegetation communities would result from the removal of 6.8 acres of Sonoran Creosotebush-Bursage Scrub (including 32 linear feet of Xeroriparian Wash), when compared to the proposed gen-tie line alignment. Long-term impacts would result from the removal of 5.0 acres of Sonoran Creosotebush-Bursage Scrub (including 33 linear feet of Xeroriparian Wash). The increase in disturbance to Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash would be less than 0.6% if the Gen-tie Line Option were selected in combination with any action alternative.

Fugitive dust from traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation.

4.16.3 Impacts to Special-status Species

Thirteen plant species that are protected under Arizona Native Plant Law are known to occur in the Project Area (see Chapter 3, Table 3.52). No federally listed endangered, threatened, candidate, or proposed plant species are known to occur in the Project Area or surrounding vegetation communities. No federally listed species are likely to occur due to a lack of suitable habitats and because the Project Area is outside of the known range of these species (Pape 2009).

Saguaro cactus is protected under Arizona Native Plant Law (ADA 2009a). The species occupies desert slopes and well-drained flats, especially rocky bajadas (Epple and Epple 1995) in the Sonoran Desert. Saguaro cacti are few and widespread in the Project Area. Under Arizona Native Plant Law, saguaros are protected as salvage restricted, which requires a permit for any impacts to the species. Any crested saguaros (saguaro cacti with a fan-shaped top) found in the Project Area would be considered highly safeguarded under Arizona Native Plant Law. No crested saguaro cacti are known to occur in the Project Area or surrounding vegetation communities.

4.16.3.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation use in the Project Area, and operation of utility systems and vehicle travel in ROWs and on roads adjacent to and within the Project Area. There would be no impacts to special-status plant species beyond any impacts associated with the existing conditions identified in Section 4.16.2.1.

4.16.3.2 PROPOSED ACTION

Under the Proposed Action, the nature and degree of temporary and long-term indirect adverse impacts to special-status plant species would be the same as for vegetation communities. All special-status plant species occurring within the 3,599.8 acres of long-term and temporary disturbance areas would be collected, salvaged, or destroyed by permit (each species in accordance with to its ADA status; see Table 3.52 and Section 4.16.1.2). Direct impacts to special-status plant species from salvage or loss would be greater under the Proposed Action than under the No Action alternative.

4.16.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, the nature and degree of temporary and long-term impacts would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 5). There would be an approximately 0.3% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Alternative A as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Alternative A than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, the nature and degree of temporary and long-term impacts to special-status species would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 4). There would be an approximately 45% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Sub-alternative A1 as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.3.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the nature and degree of temporary and long-term impacts would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 6). There would be an approximately 34% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Alternative B as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Alternative B than under the No Action alternative, but would be less than would occur under the Proposed Action or Alternative A.

4.16.3.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. This option would not change impacts to special-status plant species under either the Proposed Action or Alternative B because implementation of the option would not change the area of each vegetation community and associated special-status plant species removed or disturbed.

4.16.3.7 GENERATION TIE LINE OPTION

Short-term and long-term impacts to special-status plant species as a result of implementing the Gen-tie Line Option in combination with any action alternative would be the same as described above for vegetation communities.

4.16.4 Impacts to Invasive and Noxious Plant Species

Noxious and invasive plant species are undesirable because of their lack of forage value to livestock or wildlife, their potential toxicity to livestock or wildlife, and because they are aggressive invaders that displace native species. Two invasive plant species were observed in the Project Area during reconnaissance surveys (Pape 2009): Saharan mustard and redstem stork's bill. Mediterranean grass (*Schismus* species) is also known to occur in the Project Area. In addition, two invasive grass species, buffelgrass and red brome, also have high potential for introduction into the Project Area via transportation corridors or other project-related infrastructure where vehicle use facilitates the movement of seeds or root fragments. Buffelgrass is currently distributed along nearby transportation corridors, including SR-85, SR-86 and I-10, and red brome is widely distributed in the Sonoran Desert (Arizona-Sonora Desert Museum [ASDM] 2010).

Invasive and noxious plant species generally possess dispersal and establishment strategies that give them a competitive advantage over native plant species due to their rapid growth and ability to produce large amounts of seed and plant biomass (Sakai et al. 2001). In addition, some of these species produce allelopathic chemicals that alter surrounding soil conditions and inhibit the growth of native species.

4.16.4.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation use in the Project Area, and operation of utility systems and vehicle travel in ROWs and on roads adjacent to and within the Project Area. There would be no impacts to noxious and invasive plant species beyond any impacts associated with the existing conditions identified in Section 4.16.2.1, and there would be no project perimeter to increase the likelihood of invasion by noxious and invasive plant species (Table 4.92).

Table 4.92 Noxious and Invasive Plant Species Analysis Perimeter (linear feet) (perimeter of footprint plus all known areas of disturbance surrounding road corridors and other facilities) – All Alternatives

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Analysis perimeter	0	198,182.4	184,905.7	171,309	178,399.6

4.16.4.2 PROPOSED ACTION

The entire project perimeter would be at increased risk of invasion by noxious and invasive plant species. There would be little or no potential for noxious or invasive plant species establishment within the project footprint and other portions of the Project Area that would be kept free of vegetation through mechanical removal and the application of approved herbicides for the life of the project. Direct and indirect impacts to vegetation communities would occur where noxious or invasive species are introduced or spread in untreated disturbed soils along or adjacent to the project perimeter. Once introduced, some weed species, particularly red brome and buffelgrass, have the potential to spread into undisturbed habitats where they would disrupt biological crust diversity and functioning, and potentially exclude native plant species through aggressive competition. Once noxious or invasive plant species become established, their direct and indirect impacts to vegetation communities would increase as seeds continue to be dispersed into previously uninfested areas beyond the project boundary. The introduction and establishment of noxious or invasive plant species would also have indirect impacts to vegetation communities and wildlife by increasing fuel loading and fire frequency. If untreated, infestations of noxious or invasive plant species would continue to spread into native habitats, potentially for the life of the project, until actions are taken to curtail their advancement.

For purposes of analysis, we assume that negative impacts from the introduction and spread of noxious and invasive plant species would be proportional to the length of the project perimeter, and the number of vehicle trips associated with project activities. Under the Proposed Action, the Project Area perimeter would be 198,182.4 linear feet (see Map 2). At the peak of construction, approximately 1,000 vehicles would travel to and from the Project Area each day. Vehicles traveling from SR-85 and/or SR-86 and other routes bordered by buffelgrass and other noxious or invasive species, would have increased potential for introducing seeds or propagules from infested roadsides. Approximately 46 vehicles would travel to and from the Project Area during regular operations. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species would be greater under the Proposed Action than under the No Action alternative.

4.16.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, a 184,906-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action. Direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action, but the impact perimeter would be reduced by 13,277 linear feet (6.7%). The number of vehicle trips during peak construction and regular operations would be the same as under the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Alternative A than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, a 171,309-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action, but would occur over a reduced area because of the reduced footprint. Direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be of the same nature under Sub-alternative A1 as under the Proposed Action, but the impact perimeter would be reduced by 26,874 linear feet (13.6%). The number of vehicle trips during peak construction would be reduced by 733 trips per day (73%), with an associated reduction in direct and indirect impacts that result from the introduction and subsequent spread of noxious and invasive plant species compared to the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, a 178,400-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action, but would occur over a reduced area because of the reduced footprint. The impact perimeter would be reduced by 19,783 linear feet (10%) compared to the Proposed Action, and associated impacts from noxious and invasive plant species would be proportionally reduced. At the peak of construction, vehicle trips along untreated paved roadways would be reduced by 50 trips (5%) per day to 950 trips, with an associated reduction in direct or indirect impacts that result from the introduction and subsequent spread of noxious and invasive plant species compared to the Proposed Action. Approximately 46 vehicles would travel to and from the Project Area during regular operations, or 12.5% fewer vehicle trips than under the Proposed Action. All other direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Alternative B than under the No Action alternative, but would be less than would occur under Alternative A or the Proposed Action.

4.16.4.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. This option would not change impacts related to noxious and invasive plant species under either the Proposed Action or Alternative B because implementation of the option would entail no additional surface disturbance or changes to the project perimeter than would occur under either alternative.

4.16.4.7 GENERATION TIE LINE OPTION

The application of the Gen-tie Line Option would increase the risk for the introduction of noxious and invasive plant species into adjacent vegetation communities, when compared to the proposed gen-tie line. A perimeter increase of 13,865 feet would occur if the Gen-tie Line Option were applied to the Proposed Action, Alternative A, or Alternative B. This represents approximately a 7% increase in the perimeter of the SSEP compared to these alternatives combined with the proposed gen-tie alignment. A perimeter increase of 18,790 feet would occur if the Gen-tie Line Option were applied to Sub-alternative A1. This represents approximately a 10% increase in the perimeter of the SSEP compared to Sub-alternative A1 combined with the proposed gen-tie alignment. Vegetation treatments and other impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action.

Traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation.

4.16.5 Potential Mitigation Measures

In addition to the measures described in Chapter 3 Section 3.16.2, the protective measures described here would minimize or eliminate impacts to vegetation resources from direct and indirect disturbances associated with the Proposed Action and action alternatives. These mitigation measures would help to reduce or eliminate noxious and invasive plant species introduction and would help facilitate the successful restoration of vegetation communities. The following standards would be applicable to vegetation communities, special-status plant species, and noxious and invasive plant species.

4.16.5.1 POTENTIAL MITIGATION MEASURES FOR VEGETATION COMMUNITIES

A detailed reclamation plan would facilitate the prompt reestablishment of vegetation communities following temporary disturbances and project termination. A reclamation plan that includes monitoring and control of invasive and noxious plant species until vegetation is established would further promote successful restoration. The reclamation plan would include, but would not be limited to:

- Reclaim and revegetate all disturbed soils that would not be permanently stabilized by construction.
- Use plants salvaged on-site and/or plant materials native to the surrounding area as revegetation materials. Salvage and replanting of woody native plants and cacti is expected to be more effective than seeding due to the arid climate, vulnerability of the area to weed introduction, and high rates of seed predation.
- Salvage native plants from long-term use and temporary use areas for revegetation activities.
- Control erosion on reclaimed lands prior to seeding using mulch, cover crops, or other approved measures.
- Monitor erosion to identify any need for corrective action during vegetation establishment.
- Create microtopographic or nurse structures (such as rocks and woody debris), as needed, to facilitate plant establishment, prevent erosion, or otherwise promote revegetation success.
- Monitor vegetation establishment and diversity until desired species composition has been achieved.

- Facilitate the recovery of BSCs and vegetation by implementing the following measures:
    - *Salvage:* The objective of inoculation with BSCs is to restore site-appropriate BSC organisms and/or propagules. In short-term disturbance areas where excavation is required, to the extent feasible the top inch of BSC should be removed and retained on-site in an active state, which requires storage in ambient sunlight and moisture regimes (Belnap and Furman 1997). Active BSC organisms can be maintained by spreading salvaged crust materials 1 inch or 2 inches deep to allow sufficient sunlight and moisture to penetrate (Belnap and Furman 1997). In long-term disturbance areas, BSCs should be salvaged to the extent feasible and stored in either an active or dormant state (Belnap and Furman 1997). Active BSCs would be used in reclamation of short-term disturbance areas on-site or off-site. Dormant storage requires that BSCs are stored dry and away from moisture and sunlight (Belnap and Furman 1997). Whenever possible, BSCs should be collected as chunks and not crushed if possible (Belnap and Phillips 2003).
    - *Artificial soil stabilization* The objective of soil stabilization is to prevent soil loss due to wind-erosion or water-erosion. In both temporary and long-term disturbance areas, soils would be stabilized with coarse litter (such as straw or woody debris) and/or the installation of stabilizing vascular plants. As an additional measure, vertical installation of soil stabilizing materials, such as straw, would further enhance BSC recovery by enhancing microtopographic variation while increasing soil stability and moisture-holding capacity (Bowker 2007). Chemical soil stabilizers (e.g., polyacrilimide) have been shown to have either no effect or negative effects on BSCs (Bowker 2007).
    - *Site augmentation*: The objective of site augmentation is to restore the original microtopographic features of the site to the extent feasible, to provide establishment sites for native vegetation, augment wildlife habitat, and to restore drainage patterns. In both temporary and long-term disturbance areas, vascular plant and BSC establishment and recovery would be enhanced by the creation of microtopographic features, such as variations in the soil surface, well-positioned rocks, piles of brush, or coarse woody debris to provide partial shade and capture and hold moisture (Bowker 2007). Site augmentation methods could also include seeding with fast growing perennials to shade the soil (Bowker 2007).
    - *Inoculation*: Inoculation facilitates BSC development by distributing BSC organisms and/or propagules throughout the site (Belnap and Phillips 2003; Bowker 2007). BSC inoculant can include salvaged pieces of BSCs, or crushed BSC materials applied dry or as a slurry. Evidence that BSCs can be stored for long periods of time and retain their inoculant potential (Bowker 2007) indicates that long-term storage of salvaged BSCs is feasible. A commercial BSC inoculant can be used, but the BSC inoculant best suited to on-site conditions would be produced from locally salvaged BSC materials.

      BSC inoculant should be applied following installation of plant materials or propagules (Belnap and Warren 1998). Inoculation of soils below shrub canopies has been shown to promote greater BSC organism recovery compared to the open areas between shrubs (Belnap and Warren 1998). Inoculant should be initially targeted at the soils under shrub canopies or microtopographic features, and spread to plant interspaces as time and materials allow.

4.16.5.2 POTENTIAL MITIGATION MEASURES FOR SPECIAL-STATUS PLANT SPECIES

- Plants protected under Arizona Native Plant Law would be salvaged by local commercial salvage companies or used as on-site revegetation materials in temporary use areas.

4.16.5.3 POTENTIAL MITIGATION MEASURES FOR NOXIOUS AND INVASIVE PLANT SPECIES

The development of a Noxious and Invasive Plant Species Treatment and Control Plan in accordance with contract documents, Arizona State Law, Arizona Revised Statutes, and Executive Orders would mitigate or minimize the direct and indirect impacts described in Section 4.16.4. The management plan would be in accordance with Arizona State Law, Arizona Revised Statutes, and Executive Orders (see Chapter 3 Section 3.16.2). The plan would include, but would not be limited to the following actions:

- Treatment and control of noxious and invasive plant species will not include broadcast treatments. Noxious and invasive species treatments will avoid native vegetation areas whenever possible.
- A list of target species for control will be obtained from the ADOT Roadside Development Section.
- The Noxious and Invasive Plant Species Treatment and Control Plan will include specific protocols for monitoring and treatment of target species infestations.
- Identify, mark, and treat any existing target species infestations in the Project Area to prevent the movement or spread of seeds or root fragments.
- All earth-moving equipment, hauling equipment, and other machinery will be washed with compressed air to remove any attached seeds, roots and rhizomes, and soil or other debris prior to entering or leaving the construction site.
- Verify that any soils or other materials imported for fill or restoration activities are certified as free of noxious and invasive plant species and soil pests.
- Verify that any straw bales or other materials used for stormwater management or other mitigation or restoration activities are ADA-certified as weed free.

4.16.6 Residual Impacts

Impacts from the long-term disturbance and removal of vegetation communities would be the same as the impacts disclosed above because these impacts would remain and could not be mitigated. Residual impacts to special-status plant species due to the salvage or removal of saguaro and other ADA-protected plant species would be the same as the impacts disclosed above because these impacts would remain and could not be mitigated. However, pre-construction surveys to identify and record all affected special-status plant species would reduce the likelihood of protected plants being missed (and subsequently lost) during salvage activities. In addition, impacts to special-status plant species would be reduced where salvaged plants are used in reclamation activities off-site or retained for short-term restoration activities within the Project Area. Long-term disturbance to vegetation communities would be minimized where applicant-committed reclamation and revegetation mitigation measures are implemented immediately following project termination. The implementation of a vegetation reclamation plan would further reduce impacts to vegetation communities by 1) requiring the use of approved plant materials, 2) enforcing measures that would minimize erosion and seed loss, 3) and monitoring vegetation recovery. Impacts to vegetation communities and special-status plant species from the temporary disturbance and removal would be minimized with the implementation of the mitigation measures described in Section 4.16.5.

The implementation of a noxious and invasive plant species management plan would minimize or eliminate impacts to vegetation communities from noxious and invasive plant species. Management practices in the weed management plan would include washing vehicles and equipment prior to entering the Project Area, monitoring of untreated areas and the project perimeter, rapid revegetation of all temporary disturbance areas, and treatment of any identified infestations.

4.16.7 Short-term Uses versus Long-term Productivity

Clearing of vegetation in the Project Area footprint, linear facilities, and transportation and access corridors would negatively impact the long-term productivity of vegetation resources for the life of the project. The vegetation communities present in the Project Area are typically slow to recover following reclamation and restoration activities. Long-term productivity would be lost beyond the life of the project, because restored vegetation communities would require from a minimum of five to ten years (Bean et al. 2004) to more than fifty years (Kade and Warren 2002, Guo 2004) following project termination to be fully restored to pre-project structure and ecological functioning. The rate of recovery would be determined by the restoration methods used and seasonal and long-term climatic conditions (Bean et al. 2004). Until they are fully developed, desert vegetation communities will also possess reduced diversity (Belnap et al. 2001) and less productivity (Garcia-Pichel and Belnap 1996) compared to pre-development conditions. This loss of diversity and functioning occurs where ecologically important habitat components, such as BSCs or other ecological interactions, have been lost. Effective implementation of the mitigation measures described in Section 4.16.5 would minimize impacts to the long-term productivity of vegetation communities.

4.16.8 Irreversible and Irretrievable Commitments of Resources

The applicant-committed measures detailed in Chapter 2 (see Table 2.2) and potential mitigation measures described in Section 4.16.5 would require the reclamation of disturbed areas immediately following temporary disturbances and termination of the project. Long-term disturbance areas would constitute an irretrievable commitment of vegetation resources until active site reclamation and restoration of vegetation takes place. Irreversible commitment of vegetation resources would be limited to any permanently capped project facilities and paved roadways associated with the Proposed Action and alternatives.

4.17 Visual Resources

The visual resources impacts analysis is an assessment of landscape changes that would result from the construction and operation of the SSEP under the Proposed Action and alternatives. As discussed in Chapter 3, visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). Because changes to the characteristic landscape in the analysis area would be the primary direct impact of the SSEP on visual resources, the relative impacts of each alternative to the characteristic landscape were assessed by comparing visual contrasts (that would result from the construction and operation of the SSEP) with the existing characteristic landscapes surrounding the Project Area. Landscape panorama photographs were recorded to document existing conditions. Visual simulations of the Proposed Action and alternatives were prepared, based on the existing conditions photographs, as seen from all of the KOPs. These simulations are located in Appendix H. Table 4.93 shows the degree of contrast criteria (or the range of potential visual impacts) that were used for this assessment. The degree of contrast criteria are based on the BLM Visual Resource Contrast Rating Manual 8431 (BLM 1986b). The BLM contrast analysis methodology used to assess impacts to the landscape is described below.

Table 4.93 Degree of Contrast Criteria

Degree of Contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast beings to attract attention and begins to dominate the landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Source: BLM (1986b).

Contrast analysis is a method by which potential project-related changes to the landscape are assessed. The BLM uses this type of analysis as part of their VRM system to describe landscapes and analyze the impacts to scenic quality; the overall goal of the analysis is to apply a level of objectivity and consistency to the process. Contrast analysis can be summarized as follows: the degree to which a project or activity affects scenic quality depends on the visual contrasts created or imposed by a project on the existing landscape. These imposed contrasts can be measured by comparing the project's features with the major features in the existing landscape (BLM 1986b).

The landscape features used to compare the existing landscape with the potentially modified landscape are landscape forms, colors, textures, and lines in the foreground, middleground, and background. Landscape form refers to the unified masses or shapes of the landscape being analyzed, such as existing structures, topography, and natural objects (e.g., conical peaks, rolling grassland, flat river valleys). Landscape color refers to the colors of vegetation, soils, water, rock, sky, and existing structures. Landscape textures are the variations, patterns, density, and graininess of the landscape surface (e.g., uneven, sparse, and randomly spaced shrubs in an arid landscape; dense, tightly packed trees in an old-growth forest); and the dimensions of those surface variations (e.g., tall conifers, low shrubs, short grasses). Linear landscape features are the real or imagined paths that the eye follows when perceiving abrupt changes in form, color, or texture. These are often noticeable as the edge effect created at the boundary of two contrasting areas (e.g., a line of trees along a rocky slope or ledge, the abrupt boundary between forest and grassland, a dark ridgeline silhouetted against a bright sky). It should be noted that all of these observable landscape features (line, form, color, and texture) can be affected by other

environmental factors that include the viewing distance, motion, the angle of view of a project, atmospheric effects (e.g., haze, heat simmer, dust, smoke), lighting conditions, and time of day. These other factors are also included in assessing the potential impacts of projects and activities.

In general, project-related landscape changes that repeat the natural features of the landscape or changes that are well integrated with the existing characteristic landscape features are considered to be in harmony with their surroundings. These changes produce low or weak levels of contrast and are considered to have a low impact on existing visual resources or on the existing scenic values of the landscape. Landscape modifications that do not harmonize with the surrounding landscape are considered to be in moderate to strong contrast with that landscape; that is, the contrasts appear obvious, stand out, and can be aesthetically displeasing to viewers because they are not well-integrated with the existing natural landscape.

Under the BLM contrast analysis method, representative landscape viewpoints (KOPs) are selected for use in analyzing project-related visual impacts. Typically these points are selected from roads, trails, scenic overlooks, road crossings, communities and residences, and campgrounds: places where large numbers of people might be able to view the project for an extended length of time. Visual simulations are created to assist with the impacts analysis from these selected viewpoints. Simulations are created by taking project information (e.g., the dimensions of structures, the areas where vegetation is removed, areas where roads would be built) and then using computer graphic design to overlay images onto photographs. The degree of landscape contrasts (measured as changes in line, form, color, and texture) potentially created by a project are then compared with the existing landscape character and with the scenic management objectives (the designated VRM class objectives) for that area. The comparison allows the evaluator to determine whether the potentially imposed project-related landscape contrasts meet or exceed those designated scenic management objectives. Mitigation measures are used to minimize the visual impacts, even when the impacts meet the visual class objectives. For the SSEP, the project area lies within a designated VRM Class IV area, with management objectives that allow major modifications of the landscape and a high level of change to the landscape.

The SSEP contrast analysis consists of an assessment of visual contrasts resulting from the Proposed Action and action alternatives on the landscape. The assessment was conducted from 19 KOPs. KOPs are critical viewpoints of typical landscapes in the Project Area that a) were selected to represent the views of disturbances throughout the life of the project and that b) would be encountered by the greatest number of people. The KOPs were selected to represent critical viewpoints for each of the three sensitive viewer types (travel routes, recreation areas, and residences), including a variety of viewing conditions (e.g., cloudy, sunny, mid-morning, midday, etc.) and distance zones within the visual analysis area. Distance zones are defined as foreground/middleground (0–5 miles), background (5–15 miles), and seldom seen (screened within foreground/middleground or beyond background). In addition, project-specific distance zones were generated that consider the perception of the project. Using GIS, distance zones were generated and mapped from inventoried moderate and high-sensitivity viewers with potential views of the SSEP on federal land, including residences, recreation areas, and public travel routes (e.g., highways, state routes, and scenic roads), as identified in Section 3. The distance zones are as follows:

- 0–0.25 mile – BLM Foreground Zone
- 0.25–1 mile – BLM Foreground Zone
- 1–3 miles – BLM Foreground Zone
- 3–5 miles – BLM Middleground Zone
- 5 miles and beyond – BLM Background Zone

As noted in Section 3.17, the term *sensitive viewers* refers to BLM VRM sensitive viewing locations and associated KOPs. Eighteen of the 19 KOPs fall within the visual analysis area (see Map 18). KOP 19, identified by special interest groups and located on Quartz Peak in the Sierra Estrella Wilderness, falls outside of the visual analysis area, but it was included because there are superior (high angle of view) viewing positions from the Quartz Peak Trail within the wilderness area. Because the SSEP is proposed on BLM-managed land, the analysis also consists of an assessment of whether the proposed changes to the landscape would meet the BLM's objectives for management of visual resources, as prescribed in the Lower Gila South RMP (BLM 1985). The analysis of impacts to visual resources also considers an assessment of the changes to night sky conditions caused by the Proposed Action and alternatives. Changes to the Bortle Dark-Sky rating class of the Project Area would be the primary direct impact of the SSEP on night sky conditions. The impacts of each alternative to night skies were assessed by comparing the increases in artificial nighttime lighting from the SSEP.

4.17.1 No Action

The current landscape in the visual analysis area is characterized by flat to low desert hills and plains with low vegetative diversity typical of creosotebush flats. Existing human modifications in the Project Area are limited to dirt surface tracks and roads and a single stock pond. Under the No Action alternative, the landscape would continue to be influenced by these factors, and it would meet the BLM's objectives for management of VRM Class IV.

4.17.2 Proposed Action

4.17.2.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Under the Proposed Action, the SSEP has three types of facilities that would result in changes to the characteristic landscape: a well field, external linear facilities, and power plants. The power plants would consist of the proposed power blocks, solar fields, evaporation ponds, cooling towers, and HTF land treatment area. The SSEP solar fields, power blocks, and transmission line would occupy approximately 3,313 acres of the approximately 3,620-acre site. Underground gas and water pipelines, access roads, and other support facilities would make up the remainder of the Project Area.

Short-term visual contrasts with the characteristic landscape of the Project Area would result from activities associated with construction of the SSEP. Removal of vegetation, grading (leveling), and trenching would result in visual contrasts to the color and irregular texture and lines of the characteristic landscape over the 39-month construction period. In addition, construction equipment, vehicles, supplies, and associated project activities would be clearly visible during construction activities.

During the long-term operation of the SSEP, the regular geometric forms and strong horizontal and vertical lines associated with the solar fields, power blocks, co-firing boiler stack, and cooling towers would result in a visual contrast with the irregular, organic forms and colors of the existing landform and vegetation. _In addition, color contrast associated with the reflective solar thermal troughs would vary throughout the day as the mirrors rotate to track the sun from east to west. Although concentrated light would not be directly reflected toward any of the KOPs, the solar thermal troughs, when viewed from elevated viewing positions at certain times of the day, would reflect the sky, resulting in intermittent bright colors that would sharply contrast with the dull hues of the surrounding tan soils and grey-green vegetation. The proposed transmission line would parallel and repeat the basic visual elements of existing transmission lines that are similar in form, line, and color. The potential impacts caused by construction and operation of the SSEP under the Proposed Action and action alternatives are summarized in Table 4.99 in Section 4.17.2.3 (Key Observation Points).

Numerous parks, monuments, and other special designation areas lie within the visual analysis area. Based on computer analysis of the SSEP's viewshed, the visibility of the SSEP from these special designation areas is summarized in terms of the acres and percentage of each special designation areas (within the analysis area) from which the SSEP would potentially be visible (Table 4.94). This analysis does not factor in buildings, other structures, or vegetative screening; therefore, it is inherently conservative. The analysis was conducted for two cases: 1) the Proposed Action and Alternative A; and 2) Sub-alternative A1, which was assumed to be substantively similar to Alternative B in terms of size and impacts.

Table 4.94 SSEP Visibility from Special Designation Areas within the Visual Analysis Area

	Proposed Action and Alternative A ***Acres (% of analysis area)*** [1]	**Sub-alternative A1 (similar to Alternative B)** ***Acres (% of analysis area)*** [1]
Buckeye Hills Regional Park	2,003 (45.1%)	1,944 (43.8%)
Estrella Mountain Regional Park	6,881 (34.8%)	6,637 (33.6%)
North Maricopa Mountains Wilderness	3,699 (5.8%)	2,708 (4.2%)
Sierra Estrella Wilderness	2,564 (63.7%)	1,213 (63.1%)
Sonoran Desert National Monument	13,933 (11.1%)	12,437 (10.5%)
Woolsey Peak Wilderness	548 (9.5%)	444 (9.2%)

[1] The area in parentheses is the percentage of the special designation area that lies within the visual analysis area where the project would be potentially visible.

As discussed below under the Proposed Action and each of the action alternatives, designated VRM Class IV objectives would be met during construction and operation of the SSEP.

4.17.2.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

VRI data were developed in consultation with the BLM to develop interim VRI classifications for the SSEP in accordance with BLM VRM policy and IM No. 167-2009. The 375-MW solar plant would occupy approximately 3,528 acres of BLM land within the interim VRI area. The proposed gen-tie line and primary access road would cross approximately 19.8 acres of BLM land within the interim VRI area. The Gen-tie Line Option and primary access road would cross approximately 23.2 to 24.7 acres of BLM land in the interim VRI area. The wells, water pipeline, natural gas pipeline, and access road improvements would require 26.5 acres of BLM land within the interim VRI area.

4.17.2.2.1 Scenic Quality

The project components would occupy (solar facilities) or cross (gen-tie) Class C scenic quality (Table 4.95) on BLM land, which is associated with Rainbow Valley. Class A and B scenic quality associated with the Buckeye Hills and Sonoran Desert National Monument would not be occupied or crossed by the project. Two of the seven landscape factors, vegetation and cultural modification, which contribute to a Class C scenic quality designation would be affected by the project. Approximately 3,528 acres of vegetation would be removed to allow for the construction and operation of the project. In this regard, the local landscape setting would remain modified until the decommissioning plan is implemented and vegetation reoccupied the project ROW. The cultural modification landscape factor would also be affected by the project. Although the existing BLM-designated utility corridors and Hassayampa substation have locally modified the setting, the introduction of the project would further increase the presence of cultural modifications in the landscape. The stronger presence of cultural modifications may further degrade inventoried scenic quality in the project area, although the Class C designation would remain.

Table 4.95 Impacts within Class C Scenic Quality Rating Units

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	15.7%	15.7%	8.6%	10.3%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.08%	0.09%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.09%	0.09%	0.09%	0.09%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percentage of VRI unit within interim VRI area

4.17.2.2.2 Sensitivity Level Rating Units

All project components would exclusively occupy or cross BLM land associated with low sensitivity within and adjacent to two BLM-designated utility corridors (Table 4.96). Moderate sensitivity BLM land is associated with BLM land near the Buckeye Hills, north of the Project Area. These areas would not be affected by the project, based on the occurrence of BLM-designated utility corridors and regional cultural modifications including the Hassayampa Substation, prison, and agricultural development. BLM lands associated with high sensitivity include the Sonoran Desert National Monument located south of the Project Area. High sensitivity lands associated with the monument would not be traversed or occupied by the project.

Table 4.96 Impacts within Low Sensitivity Level Rating Units

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	18.2%	18.2%	10.0%	11.9%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.09%	0.1%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.1%	0.1%	0.1%	0.1%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percent of VRI unit within the interim VRI area

4.17.2.2.3 Distance Zones

All project components would be located in the foreground/middleground distance zone for all BLM land (Table 4.97) crossed by the project, based on views from Komatke Road, SR-85, and the Sonoran Desert National Monument. No other distance zones would be crossed or occupied.

Table 4.97 Impacts within Foreground/Middleground Distance Zones

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	13.1%	13.1%	7.2%	8.6%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.07%	0.08%	0.09%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.07%	0.07%	0.07%	0.07%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.08%	0.08%	0.09%	0.08%

[1] Percent of VRI unit within the interim VRI area

4.17.2.2.4 VRI Classes

The BLM land crossed or occupied by all project components has been identified as VRI Class IV (Table 4.98). Isolated areas of VRI Class III are associated with low lands in the Sonoran Desert National Monument and foothills of the Buckeye Hills. VRI Class II is limited to the foothills and Maricopa Mountains within the Sonoran Desert National Monument. VRI Classes II and III would not be traversed or occupied by the project. VRI Class I does not occur within the interim VRI area.

Table 4.98 Impacts within Class IV Visual Resource Inventory Classification

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	18.2%	18.2%	10.0%	11.9%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.09%	0.1%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.1%	0.1%	0.1%	0.1%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percent of VRI unit within the interim VRI area

4.17.2.3 KEY OBSERVATION POINTS

Based on the viewshed analysis described in the Affected Environment, Chapter 3, 19 KOPs were selected to represent critical and representative viewpoints for each of the three sensitive viewer types: travel routes, recreation areas, and residences (see Map 18). Selected KOPs also represent different viewing elevations and distance zones relative to the proposed SSEP. KOPs that would be visually screened from the SSEP by topography and/or vegetation would observe little to no change and are described below. The visual contrast visible from the KOPs would range from weak to moderate when the KOP occurs at a similar elevation to the SSEP to moderate to strong when the KOPs are at a higher elevation (a superior perspective) to the SSEP.

A visual resource assessment for the SSEP was completed, including visual contrast ratings and photographic visual simulations (Johnson 2009). Visual contrast ratings were completed for each of the 19 KOPs. Photographic simulations were prepared for all KOPs, and they are representative of the three sensitive viewer types, different viewing elevations, and distances. See Appendix H for photographic simulations and landscape views as seen from each KOP. It should be noted that a range of environmental factors and conditions were considered during the contrast rating assessments, besides landscape lines, forms, colors, and textures. The BLM contrast analysis method requires that angle of observation, length of time the project is in view, project size and scale, season of use, lighting or atmospheric conditions, vegetation regrowth in disturbed areas, spatial relationships landscape forms, and motion within the landscape be considered (BLM 1986). The contrast analyses described below considered these factors; when and where applicable to the analyses, they were noted in the contrast rating.

4.17.2.3.1 Travel Routes

- KOP 5 (Komatke Road): The solar fields, power block stacks, pipeline, and transmission line route would be visible in the foreground distance zone (1 mile) from this KOP. The line and color contrast from these structures would be moderate to strong throughout the day. Komatke Road is within the BLM-designated utility corridor and provides unpaved access for utility maintenance. The duration of viewing would depend on speed as the viewer travels along the length of the road. Travel toward the facility (from the east or west) would result in more prominent views of the facility than travel away from the facility. Travelers also use this route to access the Sonoran Desert National Monument, and those travelers have a higher expectation for aesthetics (e.g., natural or undeveloped landscapes). The transmission line and power block would be backdropped by the Buckeye Hills. Views of the solar fields would be partially screened by existing vegetation, which would reduce the contrasts created by the power block stacks. The project would also be viewed in the context of existing modifications, including two BLM-designated utility corridors (one that parallels Komatke Road), the minerals plant, regional landfill, and switchyard.
- KOP 7, 8 (SR-85): The SSEP would be visible from a level viewing position for a short duration (approximately 2 minutes) in the middleground distance zone (3.75 miles) from these KOPs. Visibility of the SSEP would be limited to the power blocks and transmission line within the context of the tie-in point into the Jojoba Switchyard. Existing modifications that are visible from these KOPs include the regional landfill and facilities within two BLM-designated utility corridors. The regular geometric forms and strong form and lines associated with the power block stacks and transmission line would result in a moderate visual contrast with the irregular, organic forms of the existing landform and vegetation. The distance and timing from this KOP would further reduce visual contrasts to weak or none. Atmospheric haze, heat shimmer, and fugitive dust from wind-blown exposed soil would also contribute to reducing visual contrasts by obscuring the views of the project area. These effects would have greater obscuring impacts with increased viewer distance from the Project Area. Atmospheric effects would be applicable to all of the KOP middleground views.

- KOP 11 (Rainbow Valley Road): The SSEP would be visible in the middleground distance zone (4 miles) from this KOP, though it would be partially screened by vegetation. As a result of the distance and vegetative screening, there would be weak visual contrast visible from this KOP.
- KOP 16 (Riggs Road): Travelers along this route would have level foreground views (approximately 1 mile) of the solar fields associated with the SSEP. The associated gas and water pipeline routes paralleling Riggs Road (within 0.25-mile foreground distance zone) would be visible, but they would mimic the form, line, and color of the existing road resulting in weak visual contrast with the existing landscape. The newer, project-related structures would be compatible with the existing surface disturbances caused by the road and would thus present a low degree of contrast.

4.17.2.3.2 Recreation Areas

- KOP 1 (North Maricopa Mountains Wilderness): The North Maricopa Mountains Wilderness is associated with high sensitivity viewers. KOP 1 is within the North Maricopa Mountains Wilderness and would be approximately 3.0 miles south of the SSEP. Dispersed recreation users at higher elevations or peaks would have superior views of the entire SSEP in the foreground/middleground distance zone. High sensitivity viewers would experience weak to moderate contrast levels. Vertical structures associated with the SSEP (e.g., cooling stacks) would be backdropped by the Buckeye Hills to the northwest. The solar fields would be visible, and the reflection of variable sky conditions would be intermittently visible from this KOP, although it would be seen in the context of existing modifications, including transmission lines in the BLM-designated utility corridor (located approximately 1 mile north of the KOP location).
- KOP 2, 6, 19 (Sonoran Desert National Monument): The Sonoran Desert National Monument includes recreation travel routes, multiuse trails, and trailheads associated with the Sonoran Desert National Monument and North Maricopa Mountains Wilderness. Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire SSEP in the foreground distance zone (1.25 miles) from these KOPs. The transmission line and structures associated with the power block would be backdropped by the surrounding landforms and the Buckeye Hills. The solar field would be clearly visible, and the reflective color contrast would be strong throughout the day from the elevated viewpoints. Existing modifications that are visible from these KOPs in the Sonoran Desert National Monument include the mineral plant, regional landfill, and transmission lines in the two BLM-designated utility corridors (one that parallels Komatke Road).
- KOP 3, 4 (Margie's Cove Road, West): This route is one of the few designated recreation access roads within the Sonoran Desert National Monument. Margie's Cove Road is a primitive four-wheel drive (4WD) recreation route. The SSEP would be clearly visible to motorists traveling west on Margie's Cove Road, The SSEP would come into view within the foreground distance zone, approximately 0.25 to 0.50 mile of the Komatke Road junction (KOP 3) looking north. For KOP 3, the contrast would be moderate to strong for high sensitivity viewers with level foreground views (1.25 miles) of the project. Moderate to strong contrast is anticipated for viewers with superior foreground views (approximately 2.75 miles) of the project for KOP 4. The SSEP would be intermittently screened by topography and vegetation for portions of this route between 0.50 and 1.75 miles (KOP 4), and at this distance it would be seen in context with facilities located in the existing BLM utility corridor. Topography would completely screen the SSEP after 2 miles as this route continues south into the Sonoran Desert National Monument. Views of the SSEP would be completely screened by topography for motorists traveling east on Margie's Cove Road.

- KOP 9 (Buckeye Hills Regional Park): The SSEP would be completely screened by topography and vegetation from the entire park.
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead): The Quartz Peak Trail would be approximately 18 miles from the SSEP and would have superior views of the SSEP in the background distance zone. Contrast resulting from the project would be strong from Quartz Peak. The entire facility would be visible from the KOP; however, at this distance, the geometric patterns associated with the SSEP would mimic and repeat the existing modifications associated with agricultural fields and development also visible from the trail. Reflections of the sky in the solar thermal troughs would be visible intermittently throughout the day depending on meteorological conditions. The bright reflective mirrors would contrast with the dull hues of the existing developments, fields, and surrounding tan soils and gray-green vegetation.

4.17.2.3.3 Residences

The SSEP would be completely screened by topography from residences located in Buckeye, Estrella Mountain Ranch, Palo Verde, Cotton Center, Arlington, Liberty, and Perryville.

- KOP 10 (Ray Road): Residences along Ray Road would have level views of the proposed solar fields and power block stacks located in the middleground distance zone (4 miles). Topography and vegetation would partially screen the SSEP, and the SSEP would be viewed in the context of existing landscape modifications. The regular geometric forms and strong form and lines associated with the solar fields and power block stacks would result in a weak to moderate contrast with the irregular, organic forms of the existing landform and vegetation. The distance from this KOP would further reduce contrast.
- KOP 12 (Queen Creek Road): Residences along Queen Creek Road would have level views of the proposed solar fields, power block, and transmission line route in the foreground distance zone (approximately 0.85 mile) that would be partially screened by vegetation. The regular geometric forms and strong form and lines associated with the solar fields, power block, and transmission line would result in a moderate to strong contrast with the irregular, organic forms of the existing landform and vegetation. Because views of the SSEP would be partially screened by vegetation, contrast would be reduced.
- KOP 13 (Ocotillo Road): Residences along Ocotillo Road would have an unobstructed, clear view of portions of the SSEP. The regular geometric forms and strong lines associated with the SSEP would result in a strong contrast with the irregular lines and dull colors of the surrounding soils and vegetation intermittently throughout the day. Existing structures and facilities that have modified the landscape are not visible from this distance zone and KOP.
- KOP 14 (Chandler Heights Road): Residences along Chandler Heights Road would have level views of the SSEP in the foreground distance zone (approximately 0.25 mile). Although residences would be located immediately adjacent to the SSEP, vegetation would screen most of the SSEP from view. The regular geometric forms and lines associated with the solar fields, power block, and transmission line would result in a moderate contrast with the irregular, organic forms of the existing landform and vegetation. Because most of the SSEP would be screened from view by vegetation, contrast would be reduced. Existing structures and facilities that have modified the landscape are not visible from this distance zone and viewing position.
- KOP 15 (South Hayes Road): Although residences would be located immediately adjacent to the SSEP, vegetation would partially screen those views. Existing modifications to the landscape are not visible in this distance zone. There would be a moderate contrast with the irregular lines and dull colors of the surrounding soils and vegetation.

- KOP 17 (195th Avenue): Residences would have a partially screened view of the solar fields within the foreground distance zone (approximately 2 miles). The power block and transmission line would be backdropped by the adjacent terrain. The pipeline routes would be completely screened by vegetation. The regular geometric forms and strong form and lines associated with the solar fields would result in a moderate contrast with the irregular, organic forms of the existing landform and vegetation. Because views of the SSEP, including the pipeline routes, would be partially screened by vegetation, contrast would be reduced.

The potential impacts caused by construction and operation of the SSEP under the Proposed Action and action alternatives are summarized in Table 4.99.

Table 4.99 Proposed Action and Action Alternatives Summary of Impacts by KOP

KOP by Sensitive Viewing Category	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Travel Routes				
KOP 5 (Komatke Road)	Moderate to strong line and color contrasts from structures	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate foreground contrasts; impacts reduced by vegetation screening	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 7, 8 (SR-85)	Moderate form contrasts, but distance and timing would reduce to weak	Same as Proposed Action	Weak foreground contrasts; no impacts in middleground from vegetation and topographic screening	Same as Proposed Action
KOP 11 (Rainbow Valley Road)	Weak contrasts	Same as Proposed Action	Weak contrasts from superior views of project; negligible middleground and background views from vegetation and topographic screening	Same as Proposed Action
KOP 16 (Riggs Road)	Weak contrasts	Same as Proposed Action	Weak to moderate contrasts in level foreground/middleground; negligible level foreground impacts from vegetation screening	Same as Proposed Action
Recreation Areas				
KOP 1 (Maricopa Wilderness)	Weak to moderate contrasts in foreground/middleground from superior views of project area	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate middleground contrasts from superior views of project area	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 2, 6, 19 (Sonoran Desert Wilderness)	Strong, foreground/middleground color contrasts from solar field, from elevated, superior views	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Moderate to strong foreground/middleground contrasts, from elevated, superior views of project	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 3, 4 (Margie's Cove Road)	Moderate to strong foreground/middleground contrasts, from elevated and level views	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak, level, foreground contrasts at KOP 3; weak to moderate, superior view, foreground contrasts at KOP 4	Same as Proposed Action, except contrasts reduced by a smaller project area and increased vegetation and topographic screening

Table 4.99 Proposed Action and Action Alternatives Summary of Impacts by KOP

KOP by Sensitive Viewing Category	**Proposed Action**	**Alternative A: Reduced Water Use (dry-cooled CST)**	**Sub-alternative A1: Photovoltaic**	**Alternative B: Reduced Footprint**
KOP 9 (Buckeye Hills Park)	No impacts, from total vegetation and topographic screening	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail)	Strong color contrasts from superior views of project	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate contrasts	Same as Proposed Action, except contrasts slightly reduced by smaller project area
Residences				
KOP 10 (Ray Road)	Weak to moderate form contrasts in the middleground, with partial topographic and vegetation screening; impacts reduced by distance	Same as Proposed Action	Weak contrasts; complete topgraphic and vegetation screening of project	Same as Proposed Action
KOP 12 (Queen Creek Road)	Moderate to strong form contrasts in the foreground; contrasts reduced by vegetation screening	Same as Proposed Action	Weak contrasts; complete foreground topographic and vegetation screening of project	Same as Proposed Action
KOP 13 (Ocotillo Road)	Strong line and form contrasts; unobstructed views of project	Same as Proposed Action	Weak contrasts in foreground/middleground; level foreground views partially screened by vegetation	Same as Proposed Action
KOP 14 (Chandler Heights Road)	Moderate form and line contrasts in the foreground; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground contrasts; impacts reduced by vegetation screening	Same as Proposed Action
KOP 15 (South Hayes Road)	Moderate, foreground line and color contrasts; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground contrasts	Same as Proposed Action
KOP 17 (195th Avenue)	Moderate, foreground form and line contrasts; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground/middleground contrasts, reduced by vegetation and topographic screening;	Same as Proposed Action

4.17.2.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives for public lands in the Project Area are Class IV. Under the BLM VRM system, the objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention (BLM 1986a). Under the Proposed Action, the level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.2.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Lighting for the SSEP under the Proposed Action would be designed to provide the minimum illumination needed to achieve safety and security objectives. Lighting would be shielded and directed to focus illumination downward on the desired areas and to minimize additional nighttime illumination from the SSEP. Because of the level of artificial lighting being introduced at the SSEP, skyglow resulting from the Proposed Action would not contribute to an increase in the existing skyglow and would not result in a change to the Bortle Dark-Sky rating Class 5. Under Class 5, artificial light sources are visible in most, if not all, directions, and clouds are noticeably brighter than the sky. Existing artificial light sources include residences of Rainbow Valley, the nearby landfill, tree nursery, minerals plant, and prison. Phoenix is the largest source of nighttime light and skyglow in the region, and is approximately 30 miles from the Project Area.

4.17.2.6 GLINT AND GLARE

Glint is defined as a bright, momentary flash of light; *glare* is defined as a more continuous and sustained presence of light that may appear to "sparkle" from public viewing locations. Although a visible light study has not been conducted for this project, the following conclusions are based on a literature review of glint and glare studies for solar power facilities and the *Draft Programmatic Environmental Impact Statement (DPEIS) for Solar Development in Six Southwestern States* (BLM and DOE 2010). In general, all action alternatives would produce glint and glare that could be visible to the viewing public and would increase contrast for all KOPs with views of the SSEP. However, this increase to contrast would be intermittent or limited to certain times of the day for some sensitive viewers.

Sensitive viewers with superior views of the SSEP may be affected by glint and glare throughout the day, because larger portions of the Project Area would be visible. In addition to viewer elevation, contrast associated with glint and glare is anticipated to decrease as distance between the SSEP and the viewer increases (BLM 2010). Studies indicate that luminance (light intensity) diminishes over distance exponentially; thus views from 5.3 miles or more would see levels significantly lower than that of a 50-watt bulb at 9.8 feet (BLM 2011b).

Under the Proposed Action, when solar troughs are moving into or out of stow position (shortly before dawn or after dusk), they could produce glint and glare (BLM 2010). For sensitive viewers with unobstructed level views of the SSEP, glint and glare associated with movement times would be generally limited to the first row of solar troughs. Solar troughs have highly reflective surfaces and at certain times of the day would replicate the sky. Reflections from these highly reflective surfaces result from unabsorbed light, which has a greater potential to produce glint and glare. KOPs (travel routes, recreation areas, and residences) that may have views of glint and glare for the project are discussed below.

4.17.2.6.1 Travel Routes

Travelers along SR-85 (KOPs 7 and 8) are associated with level views of the SSEP, which would occur at a distance of 3.75 miles within the middleground distance zone and would most likely not be affected by glint and glare with the project due to vegetation screening. Komatke Road (KOP 5) and Riggs Road (KOP 16) are also associated with level views of the project, which would be screened by vegetation; therefore, travel route viewers at a level viewing position would most likely not be affected by glint and glare.

Travel route viewers along Rainbow Valley Road (KOP 11) would have slightly superior views of the SSEP within the background distance zone (5 miles), and may have views of glint and glare. The project would be viewed in the background distance zone; therefore, contrast would be greatly reduced by distance.

4.17.2.6.2 Recreation Areas

Generally, dispersed recreation viewers associated with the Sonoran Desert National Monument (KOPs 2, 3, 4, 6, and 19), North Maricopa Mountains Wilderness (KOP 1), and Quartz Peak (KOP 18) would have elevated or superior views of the SSEP. Glint and glare for the SSEP would be visible from these dispersed superior viewing conditions, because a larger portion of the Project Area would be apparent. Glint and glare associated with early morning movement of the troughs may be visible for a limited duration from KOP 1, which is located southeast of the SSEP within the foreground/middleground distance zone (approximately 4 miles). KOPs 2, 3, 4, 6, and 19 are located directly south of the SSEP and would be in the foreground/middleground distance zone (between 1.5 and 2 miles). Contrast associated with glint and glare would not be greatly reduced for these KOPs, due to the proximity and superior views of the entire Project Area. Dispersed recreation viewers at Quartz Peak (KOP 18) would have superior views within the background distance zone (approximately 18 miles), which would greatly reduce contrast associated with glint and glare.

4.17.2.6.3 Residences

Residences along Ocotillo Road (KOP 13) would have partially screened views of the SSEP, which would be visible within 0.125 mile (foreground distance zone). These residences would be more likely to experience glint and glare associated with the solar troughs. Contrast associated with glint and glare would be limited to certain times of the day, primarily early morning, when the solar troughs are moving out of stow position and are directed toward the east. Residences along Chandler Heights Road (KOP 14) and Hayes Road (KOP 15) would have partially to completely screened views of the SSEP within 0.5 mile (foreground distance zone). For portions of the SSEP that are unscreened (limited to the first row of solar troughs upper portions), residences may have views of glint and glare during the early morning.

4.17.3 Alternative A: Reduced Water Use (dry-cooled CST)

4.17.3.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operation actions associated with Alternative A would be similar to those described for the Proposed Action. Under Alternative A, the SSEP would not require wet cooling towers, and the six evaporative ponds would be 2 acres in size for the 125-MW unit and 4 acres for the 250-MW unit, instead of 10 acres and 20 acres, respectively, under the Proposed Action.

The cooling towers would be replaced with an ACC in each power block, as well as two "wet surface air coolers" that would be used for auxiliary cooling. Replacing the vertical cooling towers in the SSEP would result in reduced visual contrast to the irregular forms and lines of the current landscape visible from KOPs with level views. A reduction in the size of the evaporative ponds would result in less reflective color contrast visible from the following KOPs (which would be at a higher elevation than the SSEP):

- KOP 5 (Komatke Road)
- KOP 1 (North Maricopa Mountains Wilderness)
- KOP 2, 6, 19 (Sonoran Desert National Monument)
- KOP 3, 4 (Margie's Cove Road, West)
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead)

4.17.3.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Alternative A, changes to the visual inventory caused by the SSEP would be the same as described under the Proposed Action, except that the project would occupy less area (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.3.3 KEY OBSERVATION POINTS

Under Alternative A, the contrast perceived by viewers at each KOP would be the same as under the Proposed Action, except that contrast would be slightly diminished due to the smaller evaporation ponds under this alternative. See Table 4.99 for a comparison of visual contrast between alternatives.

4.17.3.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives under Alternative A are the same as under the Proposed Action. The level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.3.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and skyglow would be the same under Alternative A as under the Proposed Action because the design and configuration of the SSEP would be the same under these alternatives except for the cooling method. As under the Proposed Action, the SSEP under Alternative A would meet BLM VRM objectives for the area.

4.17.3.6 GLINT AND GLARE

The impacts from potential glint and glare would be the same under Alternative A as under the Proposed Action.

4.17.4 Sub-alternative A1: Photovoltaic

4.17.4.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operation activities associated with Sub-alternative A1 would be similar to those described for the Proposed Action and Alternative A, except that there would be fewer changes due to the reduction in the project footprint, changes in equipment and materials, and the resulting changes to contrast levels. Contrast levels would change from predominately moderate (with strong contrasts at a few locations) under the Proposed Action to predominately weak (with moderate contrasts at a few locations) under Sub-alternative A1. Due to the existing industrial facilities, the contrast would be low both locally and regionally. The SSEP under this sub-alternative would use PV technology and would cover approximately 2,013 acres of land (1,607 fewer acres than under the Proposed Action) that would consist of the proposed PV panel arrays, inverter transformer sets, operations and maintenance buildings, and linear facilities, such as the access road, gen-tie line, water pipeline, and well field.

Visual changes due to the geometric forms, vertical lines, and concentrated light associated with the structural components of the SSEP would be the same as under the Proposed Action, except that concentrated light would not be reflected toward any sensitive viewer because PV panels are designed to minimize light reflectance. PV solar arrays would appear to be a dark color, typically appearing dark blue, when viewed from slightly elevated to superior viewing positions at certain times of the day.

4.17.4.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Sub-alternative A1, changes to the visual inventory caused by the SSEP would be the same as described under the Proposed Action, except that the project would occupy less area (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.4.3 KEY OBSERVATION POINTS

Please see Section 4.17.2.3 (Key Observation Points) for information on the selection of the KOPs for the analysis. Impacts under this alternative are the same as the Proposed Action unless otherwise noted.

4.17.4.3.1 Travel Routes

- KOP 5 (Komatke Road): Contrast would be weak to moderate for moderate sensitivity viewers with level views of the project (PV panel arrays and gen-tie line route alternatives) in the foreground distance zone (1 mile). In this distance zone, views of the panel arrays would be completely screened by vegetation. As described for the Proposed Action, this route lies within an existing utility corridor, an area typically associated with low visual sensitivity. Travelers to and from the Sonoran Desert Nation Monument raise this area to a level of moderate sensitivity.
- KOP 7, 8 (SR-85): The SSEP would be visible for a short duration in the foreground/middleground (0–5 miles) distance zone between the Arizona State Prison Complex-Lewis and the Buckeye Hills. Views of the SSEP along all other portions of this route would be level and completely screened by topography (KOPs 7 and 8). Overall, contrast would be weak for moderate sensitivity viewers using SR-85. The SSEP (PV solar arrays, access road, water pipeline, and well site) would be obstructed by vegetation and topography for viewers in the middleground distance zone (approximately 3.75 miles). Also, viewing would be in the context of the regional landfill and two BLM-designated utility corridors; therefore, impacts from the project would be reduced by surrounding development.

- KOP 11 (Rainbow Valley Road): Topography, vegetation, and development would partially or completely screen SSEP facilities (in the background distance zone) along most portions of this route. Moderate sensitivity viewers with superior views of the Project Area would see weak contrasts between the facility and surrounding landscape. The SSEP PV panel arrays would be viewed in the background distance zone (5 miles), and visibility of the SSEP would be minimized due to screening by vegetation. In addition to vegetation screening, the surrounding landscape has been modified by agricultural and commercial development; therefore, impacts from the project would be reduced by surrounding development.
- KOP 16 (Riggs Road): The SSEP would be located in the foreground/middleground distance zone from this route, and views of its facilities would be partially screened by vegetation. A weak to moderate contrast is anticipated for moderate sensitivity viewers with level views of the SSEP. Travelers using this route would also have foreground views (approximately 1 mile) of the PV panel arrays, which are associated with a moderate-strong level of visual change. However, at a level viewing condition, views of the PV panel arrays would be completely screened by vegetation.

4.17.4.3.2 Recreation Areas

- KOP 1 (North Maricopa Mountains Wilderness): Dispersed recreation users at higher elevations or peaks would have superior views of the entire project in the middleground distance zone. The project would create weak to moderate contrasts. The project would be visible, but would be seen in the context of existing development that includes the BLM-designated utility corridor.
- KOP 2, 6, 19 (Sonoran Desert National Monument): Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire project in the foreground/middleground distance zone. High sensitivity viewers would see a moderate-strong contrast due to superior views of the entire proposed facility in the foreground distance zone (1.25 miles).
- KOP 3, 4 (Margie's Cove Road, West and East): For Margie's Cove Road West (KOP 3), contrasts would be weak for high sensitivity viewers with level foreground views (1.25 miles) of the SSEP rather than moderate to strong because of intermittent vegetation and topographic screening between 0.5 and 1.75 miles, and it would be seen in the context of the existing utility corridor. After 2 miles, the project would be completely screened by topography. For Margie's Cove Road East (KOP 4), weak to moderate contrast is anticipated for viewers with superior foreground views (approximately 2.75 miles) of the SSEP rather than a moderate to strong contrast as in under the Proposed Action.
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead): The contrast resulting from the SSEP would be weak to moderate from Quartz Peak. The superior views at higher elevations from this KOP would be just beyond the background distance zone (at approximately 18 miles); therefore, the long viewing distance would mitigate the view of the Project Area.

4.17.4.3.3 Residences

- KOP 10 (Ray Road): The SSEP visual contrasts would be weak for high sensitivity residential viewers (located approximately 5 miles to northeast of the Project Area). Residents along the eastern portion of the road would have limited views of the project. These residents would have level views, and topography and vegetation would completely screen middleground views of the project, rather than partially screen the project, as under the Proposed Action.
- KOP 12 (Queen Creek Road): Overall, weak contrast is anticipated for high sensitivity residential viewers along Queen Creek Road. Residential viewers would have level views of the proposed PV panel arrays in the foreground distance zone (approximately 1.6 miles); however, views would be completely screened by vegetation.

- KOP 13 (Ocotillo Road): Residences adjacent to the eastern side of the Project Area would have level foreground/middleground views that would be partially screened by vegetation. Although residences along Ocotillo Road lie near the SSEP (at approximately 1 mile), vegetation screening would obstruct views of the PV panel arrays and would produce weak project visual contrasts.
- KOP 14, 15 (Residences along Chandler Heights and Hayes Road): High sensitivity residential viewers would see weak visual contrasts. Residences would have level views of SSEP facilities in the foreground distance zone (at approximately 1.4 miles from the Project Area); however, existing vegetation would partially screen views of the PV panel arrays.
- KOP 17 (195th Avenue): Residences located to the southeast of the Project Area (approximately 3 miles) may have partially to completely screened foreground/middleground views of the project. Within the middleground distance zone of the Project Area (approximately 3 miles), residences would have completely screened level views of the PV panel arrays; however, the proposed gen-tie line and the Gen-tie Line Option would be backdropped by adjacent terrain, creating weak visual contrasts.

4.17.4.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives under Sub-alternative A1 are the same as under the Proposed Action, with the Project Area sitting within designated VRM Class IV landscapes in both cases. Under VRM Class IV, management objectives allow for major landscape modification and the level of change can be high. Project activities are allowed to dominate the landscape and be a focus of casual viewer attention; however, management objectives require that every effort be made to mitigate the impacts of activities. Under this alternative, the level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and it would meet BLM VRM Class IV objectives.

4.17.4.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and the extent of skyglow would be the same as under the Proposed Action, except that it would be reduced by approximately 30% due to the smaller project footprint.

4.17.4.6 GLINT AND GLARE

PV panels do not have an equivalent stow position as solar troughs because the panels are much less susceptible to damage from high wind events or debris. A PV plant with single-axis tracking technology typically stows between 0 and 20 degrees above horizontal when not in operation. The range of motion for these trackers is confined to the angles at which they would track the sun: generally 45 degrees above horizontal in either direction. A typical fixed panel PV plant has panels installed at approximately 20–35 degrees above horizontal and are permanently fixed in a southern facing skyward direction; therefore, no movement of the panels is possible.

Sub-alternative A1 would be significantly less reflective because PV panel surfaces are designed specifically not to reflect light, thus reducing the potential for glint and glare (U.S. Air Force 2011). In addition, the PV panels of this alternative would have a lower profile than the solar troughs of the Proposed Action (approximately 20 feet tall), which would reduce visibility when viewed from level viewing positions. Overall, Sub-alternative A1 would minimize the potential for glint and glare because of the less reflective panel surfaces, smaller structures, and reduced project footprint.

KOPs that may have views of glint and glare for Sub-alternative A1 are discussed below.

4.17.4.6.1 Travel Routes

Travel route glint and glare impacts under Sub-alternative A1 would be the same as under the Proposed Action, with one exception. Along Rainbow Valley Road (KOP 11), views of glint and glare may have slightly lower contrast levels than those under the Proposed Action due to differences in technology.

4.17.4.6.2 Recreation Areas

Recreation area glint and glare impacts under Sub-alternative A1 would be the same as under the Proposed Action, except that there would be no glint and glare at KOP 1 associated with early morning movement of solar troughs.

4.17.4.6.3 Residences

Residential viewers (KOPs 10, 12, 13, 14, 15, and 17) associated with level views would not be affected by glint and glare for Sub-alternative A1, because the project would be obstructed by vegetation.

4.17.5 Alternative B: Reduced Footprint

4.17.5.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operations associated with Alternative B would be similar to those described for the Proposed Action. Under Alternative B, the SSEP would have a 30% smaller solar field layout, would produce less energy, and would result in a smaller area of disturbance than under the Proposed Action. The types of visual contrasts associated with Alternative B would be similar to those described under the Proposed Action, but because they would occur within a smaller geographic area, they would be less apparent from KOPs.

Because the reduced footprint of the SSEP under Alternative B would not be apparent from KOPs at similar elevations with level views, the visible visual contrasts would be the same as those described for the Proposed Action. KOPs that would have level views of the SSEP include those from SR-85, Rainbow Valley Road, and Riggs Road as well as each of the residential KOPs.

4.17.5.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Alternative B, changes to the visual inventory from the SSEP would be the same as described under the Proposed Action, except that the project would occupy approximately one third fewer acres (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.5.3 KEY OBSERVATION POINTS

Because the reduced footprint of the SSEP under Alternative B would be apparent from KOPs at higher elevations, the visible visual contrasts would be similar to those described under the Proposed Action, but they would occur over a smaller geographic area. Contrasts in form, line, and color would diminish more over distance than those under the Proposed Action. Under Alternative B, impacts on KOPs would be the same as the Proposed Action with the following exceptions:

- KOP 5 (Komatke Road): The solar fields, power block stacks, pipeline, and transmission line route would be visible in the foreground distance zone (1 mile) from this KOP. The 30% smaller solar field would result in contrasts apparent over a smaller area.
- KOP 1 (North Maricopa Mountains Wilderness): The solar fields would be less visible than under the Proposed Action. The reflection of variable sky conditions would be similar to the Proposed Action and would be intermittently visible throughout the day.
- KOP 2, 6, 19 (Sonoran Desert National Monument): Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire SSEP in the foreground distance zone (1.25 miles) from these KOPs. The solar field would be clearly visible, and the reflective color contrast would be strong throughout the day from the elevated viewpoints.
- KOP 3, 4 (Margie's Cove Road, West): The 30% smaller solar field footprint would be clearly visible to motorists traveling west on Margie's Cove Road. The SSEP would come into view within the foreground distance zone, approximately 0.25–0.50 mile of the Komatke Road junction (KOP 3) looking north. The SSEP would be screened by topography and vegetation more so under Alternative B than under the Proposed Action, as result of the smaller footprint (KOP 4).
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead): The 30% smaller solar field footprint would be less apparent from this distance than under the Proposed Action. The entire facility would continue to be visible from the KOP, and reflections of the sky in the solar thermal troughs would be clearly visible intermittently throughout the day, depending on meteorological conditions. The bright reflective mirrors would introduce similar contrasts as the Proposed Action.

4.17.5.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives would be met under Alternative B, as under the Proposed Action. However, the project footprint would be reduced by approximately 30%. The level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.5.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and the extent of skyglow would be the same as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.

4.17.5.6 POTENTIAL GLINT AND GLARE IMPACTS

The potential glint and glare impacts would be the same under Alternative A as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.

4.17.6 Reduced Water Use Option–Brine Concentrator

The brine concentrator would be located in the power block site of each alternative. The addition of a brine concentrator would not result in additional changes to the characteristic landscape of the Project Area under either the Proposed Action or Alternative B.

4.17.7 Generation Tie Line Option

Under the action alternatives, three SSEP facilities would result in changes to the characteristic landscape: a well field, external linear facilities, and power plants. The application of the Gen-tie Line Option would apply to external linear facilities only. As with the proposed gen-tie line alignment, short-term visual contrasts would be created by Gen-tie Line Option construction activities, such as the removal of vegetation, grading (leveling), and trenching, and the presence of construction equipment, vehicles, and supplies. During the long-term operation of the SSEP, the Gen-tie Line Option transmission line would parallel and repeat the basic visual elements of existing transmission lines that are similar in form, line, and color.

Because the gen-tie line is the most visually prominent feature of the Gen-tie Line Option, changes to miles of line are an appropriate measure of impacts. If the Gen-tie Line Option were added to any of the action alternatives, there would be an increase of 0.4 mile of line when compared to the proposed gen-tie line. Using a total of 3.0 miles of line for the Proposed Action, Alternative A, and Alternative B, this represents a 13% increase in gen-tie line miles under these alternatives. Using a total of 3.2 miles of line for Sub-alternative A1, this also represents a 13% increase in gen-tie line miles under this alternative.

4.17.7.1 POTENTIAL MITIGATION MEASURES

A number of mitigation measures could be used to reduce or eliminate impacts to visual resources and scenic quality during construction and operation of the project, and following project closure. The BLM has identified the following potential mitigation measures for the Proposed Action and the action alternatives, which may be selected for implementation in the ROD.

4.17.7.1.1 General Mitigation

- To reduce foreground and middleground impacts, a suitable BLM environmental color (from Color Chart CC-001) would be used to diminish structural color contrasts (for example, transmission line towers, support structures for solar collectors, buildings, etc.). A preliminary assessment has identified Slate Gray (5Y 6/1) as the recommended color. This environmental color is composed of a color and hue (the shade or tint). Final color selection would be based on the BLM standard method used to select colors. A careful study of the site would be performed to identify appropriate colors and textures for materials; both summer and winter appearance would be considered as well as seasons of peak visitor use. The choice of colors would be based on the appearance at typical viewing distances and consider the entire landscape around the proposed development. Appropriate colors for smooth surfaces often need to be two to three shades darker than the background color to compensate for shadows that darken most textured natural surfaces. The study would reference the BLM Standard Environmental Color Chart CC-001 and guidance when selecting colors. The simulations and field assessment would be used to determine the background color shades, and an appropriate color would then be selected. The effectiveness of this color would be field-assessed.
- Solar troughs should have the backs color treated, as needed, to reduce visual contrast with the landscape setting. One option is to use Acciona's method for accomplishing this contrast reduction using a tinted mirror product that provides added protective strength to the front panels to keep them from shattering.

- Landform grading, vegetation, or fencing in limited cases would be used to interrupt the line of site from nearby KOPs at or near the same elevation of the project.
- Vegetation and ground disturbance would be minimized near roads, and the use of existing clearings would be maximized.
- Topsoil from the site would be stripped, stockpiled, and stabilized before excavating earth for facility construction.
- All electrical collector lines and pipelines would be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance).
- A careful study of the site shall be performed to identify appropriate colors and textures for materials; both summer and winter appearance shall be considered as well as seasons of peak visitor use. The choice of colors shall be based on the appearance at typical viewing distances and consider the entire landscape around the proposed development. Appropriate colors for smooth surfaces often need to be two to three shades darker than the background color to compensate for shadows that darken most textured natural surfaces. Reference the BLM Standard Environmental Color Chart CC-001 and guidance when selecting colors. Materials and surface treatments would repeat and/or blend with the existing form, line, color, and texture of the landscape.
- Appropriately colored materials would be selected for structures, or appropriate stains/coatings would be applied to blend with the project's backdrop.
- Materials, coatings, or paints having little or no reflectivity would be used whenever possible.
- Grouped structures would all be painted the same color to reduce visual complexity and color contrast.
- Aboveground pipelines would be painted or coated to match their surroundings, or other equally effective treatment.
- Mirrors/heliostats would be deployed and operated to avoid high-intensity light (glare) being reflected toward off-site ground receptors. Where off-site glare is unavoidable and Project Area/ off-site spatial relationships favor effective results, fencing with privacy slats or similar screening materials would be employed.
- Electricity transmission-distribution projects would use nonspecular conductors and nonreflective coatings on insulators.
- The use of non-necessary and/or nonsafety–related signs and project construction signs should be minimized; necessary signs would be made of nonglare materials and use unobtrusive colors; reverse sides of signs and mounts would be painted or coated using the most suitable color selected from the BLM Standard Environmental Color Chart to reduce color contrasts with the existing landscape; however, placement and design of any signs required by safety regulations must conform to regulatory requirements.
- Commercial symbols or signs and associated lighting on buildings or other structures would be prohibited, except where basic information is needed to identify the site (particularly for safety reasons).
- "Good housekeeping" procedures would be developed to ensure that the site is kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards. Design features regarding waste management would be applied.

4.17.7.1.2 Night Sky Mitigation

- A lighting plan would be prepared that documents how lighting will be designed and installed to minimize night-sky impacts during facility construction and operations phases. Lighting for facilities would not exceed the minimum number of lights and brightness required for safety and security, and would not cause excessive reflected glare. Full cut-off luminaires would be used to minimize upward shining lighting. Lights would be directed downward or toward the area to be illuminated. Light fixtures would not spill light beyond the project boundary. Lights in high illumination areas not occupied on a continuous basis would have switches, timer switches, or motion detectors so that the lights operate only when the area is occupied. Where feasible, vehicle-mounted lights would be used for night maintenance activities. Wherever feasible, consistent with safety and security, lighting would be kept off when not in use. The lighting plan would include a process for promptly addressing and mitigating complaints about potential lighting impacts.

4.17.7.1.3 Glint and Glare Mitigation

- The SSEP would be adequately screened by existing vegetation or through the application of perimeter fencing to reduce contrast from glint and glare for KOPs with level views. Consideration for the height of the fence is necessary.
- Security fencing would be polyvinyl coated the selected color of choice to eliminate shine and glare from the galvanized surfaces; or, galvanized surfaces would be treated (darkened) to reduce glint and glare. Other reflective surfaces could be treated to reduce the potential for glint and glare as long as the treatment would not impair proper function of the equipment or structure. Prior to construction, a study would accurately assess and quantify potential glinting and glare effects of the approved alternative. It would also determine potential health, safety, and visual mitigation associated with glinting and glare effects. The study would be conducted by qualified individuals using appropriate and commonly accepted software and procedures.

4.17.7.1.4 Construction Mitigation

- A pre-construction meeting with BLM landscape architects or other designated visual/scenic resource specialist would be held before construction begins to coordinate on the VRM mitigation strategy and confirm the compliance-checking schedule and procedures. Final design and construction documents will be reviewed for completeness relevant to the visual mitigation elements assuring that requirements and commitments are adequately addressed. The construction documents would include, but not limited to grading, drainage, revegetation, vegetation clearing and feathering plans and demonstrate how VRM objectives will be met, monitored, and measured for conformance.
- Project developers would integrate interim/final reclamation VRM mitigation elements early in the construction, which may include treatments such as thinning and feathering vegetation along project edges, enhanced contour grading, salvaging landscape materials from within construction areas, defining special revegetation requirements, etc.
- Reduce visual impacts during construction by clearly delineating construction boundaries. Within interim reclamation areas (those areas not intended for long-term use), impacts will be reduced by minimizing areas of surface disturbance within those boundaries; preserving vegetation to the greatest extent possible; using undulating surface disturbance edges; stripping, salvaging, and replacing topsoil; contoured grading; controlling erosion; using fugitive dust suppression techniques; and restoring exposed soils to their original contour and vegetation.

- An interim reclamation plan would be in place prior to construction. Interim reclamation of the construction site would begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of impacted areas as quickly as possible.
- Existing rocks, vegetation, and drainage patterns would be preserved to the maximum extent practicable, particularly within temporary use areas.
- Brush-beating or mowing, or using protective surface matting rather than vegetation removal would be done where feasible.
- For interim reclamation areas, slash from vegetation removal would be mulched and spread to cover fresh soil disturbances as part of the revegetation plan. Slash piles would not be left in sensitive viewing areas. All areas of disturbed soil within interim reclamation areas would be reclaimed by using weed-free native grasses, forbs, and shrubs representative of the surrounding and intact native vegetation composition and/or use non-native species, if necessary to ensure successful revegetation.
- Graveled-surface visual color contrast would be reduced with approved color treatment practices; or, gravel will be of a color to effectively and equivalently reduce contrasts.
- Horizontal and vertical pipeline bending would be used in place of cut-and-fill activities where feasible.
- Road-cut slopes would be rounded, and the cut-and-fill pitch would be varied to reduce contrasts in form and line; the slope would be varied to preserve specimen trees and nonhazardous rock outcroppings.
- Topsoil from cut-and-fill activities would be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles would not be left in sensitive viewing areas.
- Disposal of excess fill material downslope would be avoided to avoid creating color contrast with existing vegetation and soils.
- Excess cut-and-fill materials would be hauled in or out to minimize ground disturbance and impacts from fill piles.
- Communication and other local utility cables would be buried where feasible.
- Culvert ends would be painted or coated to reduce color contrasts with existing landscape. Alternatively, galvanized ends would be treated (darkened) to reduce glare.
- No paint or permanent discoloring agents would be applied to rocks or vegetation to indicate surveyor construction activity limits, except in areas defined and designated for disturbance.
- All stakes and flagging would be removed from the construction area and disposed of in an approved facility.

4.17.7.1.5 Operations Mitigation

- The project developer would maintain revegetated surfaces (from interim reclamation and site decommissioning) until a self-sustaining stand of vegetation is re-established and visually adapted to the undisturbed surrounding vegetation. For new areas of disturbance (beyond the scope of this NEPA analysis), no new disturbance would be created during operations without completion of a VRM analysis and approval by the authorized officer.

- Interim restoration would be undertaken during the operating life of the project as soon as possible after disturbances.
- Maintenance activities would include fugitive dust abatement (in arid environments) and noxious weed control.
- Road maintenance activities would avoid blading existing forbs and grasses in ditches and adjacent to roads.
- Painted facilities would be kept in good repair and repainted when color fades or flakes increase visual contrast.
- As applicable, color-treated solar panel/trough backs would be kept in good repair and retreated when color fades and flakes.

4.17.7.1.6 Post-operations Decommissioning and Site Reclamation Mitigation

- A decommissioning and site reclamation plan, including visual impact design features, would be in place prior to construction, and reclamation activities would be undertaken as soon as possible after disturbances occur and be maintained throughout the life of the project.
- Review pre-development visual conditions(e.g. inventoried visual quality rating [A, B, and C] and integrity), and restore the visual elements of form, line, color and texture to pre-development visual compatibility or to that of the surrounding landscape setting conditions, whichever achieves the greater visual quality and ecologically sound outcome.
- A decommissioning and site reclamation plan would be developed, approved by the BLM, and implemented. The plan would require that all aboveground and near-ground structures be removed. Some structures would only be removed to a level below the ground surface that will allow reclamation/restoration. Topsoil from all decommissioning activities would be salvaged and reapplied during final reclamation. The plan would include provisions for monitoring and determining compliance with the project's visual mitigation and reclamation objectives.
- Soil borrow areas, cut-and-fill slopes, berms, water bars, and other disturbed areas would be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to a rough texture would trap seed and discourage offroad travel, thereby reducing associated visual impacts.
- Cut slopes would be randomly scarified and roughened to reduce texture contrasts with existing landscapes and aid in revegetation.
- A combination of seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction enabling direct transplanting would be considered. Where feasible, native vegetation would be used for revegetating, establishing a composition consistent with the form, line, color, and texture of the surrounding undisturbed landscape.
- Stockpiled topsoil would be reapplied to disturbed areas and the areas revegetated by using a mix of native species selected for visual compatibility with existing vegetation, where applicable, or a mix of native and non-native species if necessary to ensure successful revegetation.
- Gravel and other surface treatments would be removed or buried.
- Rocks, brush, and forest debris would be restored whenever possible to approximate pre-existing visual conditions.

- Edges of revegetated areas would be feathered to reduce form and line contrasts with the existing landscapes.
- A decommissioning VRM monitoring and compliance plan would be prepared by the operator and approved by the BLM that establishes the schedule and terms for monitoring and conditions and methods of measurement for determining compliance.

4.17.8 Residual Impacts

The effectiveness of using standard desert colors for painted facilities would, in general, be limited by the distance of most facilities to KOPs and the presence of other sources of contrast. The BLM's mitigation handbook for fluid minerals (BLM 2007c) states that the effectiveness of color mitigation diminishes over distance. Beyond approximately 1,000 feet, color becomes less effective for structural mitigation; however, hue does remain effective for much longer distances. To reduce foreground and middleground residual impacts, BLM Environmental Color Slate Gray (5Y 6/1) is recommended for use to diminish structural color contrasts. Selection of this color was based on the BLM standard method used to select color, which is to apply a color tone approximately two shades darker than the landscape background color. The simulations were used to determine the background color shades, and an appropriate color was then selected.

It is likely that large structures (solar arrays, power blocks) and linear features (transmission lines and support towers) would be visible after mitigation measures have been applied. The relatively flat landscape surrounding the SSEP precludes topographic hiding of the structures, and the height and width of the transmission lines are not likely to be hidden through color mitigation. Roads and access ways within the Project Area would probably remain visible from superior views after edge feathering because of the color contrasts created by exposed soil, loss of vegetation, and/or paving. Mitigation measures such as fencing may not effectively reduce contrast for KOPs at higher elevations. The presence and movement of construction and operations vehicles, heavy equipment, and project personnel trucks and automobiles would have a residual impact on visual quality after mitigation because mitigation would be unlikely to reduce the color and form contrasts created by these vehicles during the life of the project. The typically slow revegetation and soil coverage during reclamation in this arid region would create long-term color and line contrasts with the surrounding vegetated landscape.

4.17.9 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would require short-term and long-term uses of land and other resources for renewable energy. Implementation of the SSEP would create long-term disruptions of the characteristic landscape from soil and vegetation disturbances and would change the land use from a natural setting to an industrial setting (with industrial uses). This change to the landscape would continue throughout the lifetime of the SSEP.

4.17.10 Irreversible and Irretrievable Commitments of Resources

Changes to the characteristic landscape would occur over the lifetime of the SSEP. The SSEP would have an effective lifetime of 30 years. All visible structures and materials would be removed from the Project Area and surface contours would be restored. There would be no irreversible impacts to the landscape of the area; however, it could take years before the project footprint is no longer visible. Even when vegetation is established during reclamation efforts, the composition of species in the recovery area is often different than the original vegetation community. Typically grasses would establish early on, whereas shrubs would take much longer to reestablish. The project footprint would visibly persist for many years beyond the project completion.

There would be irretrievable impacts associated with the operation of the SSEP. The visual contrasts that would result from the introduction of facilities associated with the SSEP would be an irretrievable loss of the characteristic landscape until the SSEP operation is closed and reclamation activities have been completed.

4.18 Water Resources

Impacts to water resources are discussed below in two sections: surface water resources (Section 4.18.1) and groundwater resources (Section 4.18.2). These impacts are further divided and discussed in terms of potential impacts to water resources resulting from project construction and project operation and maintenance.

4.18.1 Surface Water

4.18.1.1.1 Floodplains and Washes

The Project Area is located on a surface water drainage divide between two watersheds: the Waterman Wash watershed and the Rainbow Wash watershed. The eastern portion of the Project Area is located in the Waterman Wash watershed. Surface water flows in small ephemeral drainages on the eastern portion of the Project Area. This surface water drains to an unnamed tributary to Waterman Wash, and ultimately to the Gila River. Surface water also flows in small ephemeral drainages on the western portion of the Project Area. This surface water drains to Rainbow Wash, and ultimately to the Gila River. Therefore, the analysis area for floodplains and washes consists of the Waterman Wash watershed, including the unnamed tributary to Waterman Wash; and the Rainbow Wash watershed, including Rainbow Wash (Map 26). This analysis area is defined for floodplains and washes because a portion of the precipitation that falls on the watersheds flows to drainages across the Project Area, discharges to either Rainbow Wash or Waterman Wash, and flows to the Gila River.

Surface water resources that would be impacted under the Proposed Action and the other action alternatives include disturbance or removal of drainages and pending Federal Emergency Management Agency (FEMA) floodplains ("floodplains"), and changes in water quantity and water quality. The number and linear miles of drainages disturbed, and the acres of floodplains disturbed, are used as the primary means of evaluating and comparing the impacts to surface water conveyance that would result from the implementation of each alternative. Changes in surface water quantity are evaluated using estimates of groundwater that would be introduced to the surface from well testing. Changes in surface water quality are evaluated on the basis of the potential for change to water chemistry (i.e., increased suspended solids) and by the potential for a release of hazardous materials or solid wastes. These potential impacts to surface water resources are discussed below for the No Action alternative, the Proposed Action, and other action alternatives during construction and operation and maintenance of the SSEP.

4.18.1.1.2 Water Quality

The analysis area for water quality comprises the Waterman Wash and its tributaries, Rainbow Wash and its tributaries, and the Gila River between Waterman Wash and Rainbow Wash. Several reaches of the Gila River downstream of the Project Area are impaired by low dissolved oxygen, selenium, boron, DDT metabolites, toxaphene in fish tissue, and chlordane in fish tissue. These compounds are typically associated with agricultural irrigation practices. Construction, operation, and maintenance of the SSEP would not generate these types of compounds and therefore would not contribute to the downstream impairment due to these pollutants.

4.18.1.1.3 Surface Water Quantity

Under the Proposed Action and other action alternatives, changes in surface water quantity are not expected to occur from evaporation. This is because precipitation and surface water runoff in the proposed solar field would be collected in stormwater detention basins and then released to match the pre-

development hydrological conditions. The basins would be designed to drain within 36 hours of a storm event. The location of these stormwater detention basins and their outfalls to existing washes are shown in Map 7 and Figure 2.9. In addition, water draining from the upper reaches of the affected watersheds would be rerouted around the solar field and discharged to the same points identified on Map 7 and Figure 2.9. Reductions in surface water quantity due to losses by evaporation are expected to be small due to the short residence time of water detained in the stormwater basins. Therefore, impacts to surface water quantities due to evaporation are not discussed further.

4.18.1.2 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation. No drainages or floodplains would be disturbed by these land uses and there would, therefore, be no impacts to stormwater, floods, or surface water flows in the analysis area.

4.18.1.3 PROPOSED ACTION

4.18.1.3.1 Impacts to Surface Water Resources during Construction

4.18.1.3.2 Water Quality

Under the Proposed Action, impacts to surface water resources during construction of the SSEP would be primarily associated with surface-disturbing activities. The use of heavy construction equipment would cause compaction of near-surface soils and soil scarification and loosening. This soil disturbance would increase the risk of additional surface water runoff, thereby increasing erosion and the transport of sediment from adjacent areas. Clearing and grading during construction would also expose soils to erosion. Soils disturbed during clearing and grading would be susceptible to water erosion and could be transported as suspended solids and deposited as sediment in drainages, washes, and floodplains.

These effects would be temporary during the initial phases of construction prior to the completion of stormwater detention measures. Existing hydraulic studies would be used to estimate pre-construction surface water flow depths and velocities within drainages on the Project Area. Discharge of stormwater during the SSEP's construction period would be permitted through an AZPDES permit. To further reduce the risk of increased erosion and sediment transport during construction, Boulevard would implement the applicant-committed environmental protection measures and construction-related BMPs (presented in Chapter 2) listed below:

- *Clean-up and Site Reclamation:* All post-construction ROWs would be restored, as required by the BLM. All practical means would be made to restore the land to its original, natural drainage patterns. Because revegetation would be difficult in many areas of the Project Area due to low amounts of precipitation, all practicable measures would be taken to minimize disturbance during construction.
- *Reclamation of Temporary Disturbance:* All temporarily disturbed areas would be reclaimed to as close to their pre-construction conditions as possible, as required by the BLM. Temporary access roads used during construction would also be regraded and restored to pre-existing function and grade.
- *Erosion Control:* Temporary drainage ditches and berms would be designed around construction work areas, soil stockpile areas, and excavation areas to minimize the amount of potential pollutant or sediment-laden surface water runoff.

Changes in surface water quality would occur if surface water flows from infrequent storm events transport disturbed soils during construction of the SSEP. In this situation, surface water quality would be degraded by the addition of suspended solids. This risk would be present at all locations where road and pipeline grading and trenching activities are conducted near drainages and floodplains. However, the risk of increasing suspended solids concentrations in surface water would be the highest during construction of the proposed solar field where all drainages and floodplains would be removed. The Proposed Action would be permitted under an AZPDES permit for construction projects and would implement a SWPPP.

The use of heavy equipment during construction would increase the risk of impact (contamination) to surface water quality due to accidental releases, spills, and leaks of equipment fluids, including fuels, lubricants, and degreasers. Vehicle refueling, equipment failure, and storage of hazardous substances would create an increased risk of surface water contamination if a spill or release were to occur. Potential contamination of surface water during construction would also result from accidental spills during the handling of stored hazardous chemicals and solid wastes. However, the SPP developed for the Proposed Action also outlines spill prevention practices, emergency response and cleanup procedures, and storage protocols. All contractors involved with the construction of the SSEP under the Proposed Action would be required to adhere to the protocols outlined in the SPP and environmental protection measures described in Chapter 2. As a result of adherence to spill prevention and control measures, any accidental releases, spills, or leaks would not result in surface water contamination above regulatory limits for these constituents in surface water.

Surface discharge of contaminated hydrostatic testing waters would also increase the risk of impact to surface water quality. To reduce this risk, Boulevard has developed a hydrostatic testing plan that describes appropriate measures to minimize environmental impacts. More specifically, after hydrostatic testing is completed, the test water would be discharged to the surrounding area pursuant to the construction SWPPP, unless the chemical analysis shows that the water is contaminated. In this case, the water would be properly disposed at an appropriate off-site waste facility. In the event that the hydrostatic testing water is disposed off-site, changes in surface water quantity due to surface discharge of these waters (as described above) would be eliminated. No impacts to water quality would be anticipated because all of the discharged water would have to meet the regulatory water quality discharge criteria.

Storage, handling, and disposal of fluids during well drilling for the SSEP would present an increased risk of impact (contamination) to surface waters if a spill or release occurred. However, all drilling fluids would be stored and handled according to environmental protection measures outlined in the SPP developed for the Proposed Action and other action alternatives. Therefore, storage, handling, and disposal of drilling fluids would not result in surface water contamination above regulatory limits for these constituents in surface water.

4.18.1.3.3 Floodplains and Drainage

Under the Proposed Action, impacts to surface water resources during construction of the SSEP would be primarily associated with surface-disturbing activities. The use of heavy construction equipment would cause compaction of near-surface soils and soil scarification and loosening. This soil disturbance would increase the risk of additional surface water runoff, thereby increasing erosion and the transport of sediment from adjacent areas. Clearing and grading during construction would also expose soils to erosion. Soils disturbed during clearing and grading would be susceptible to water erosion and could be transported as suspended solids and deposited as sediment in drainages, washes and floodplains.

Construction of the SSEP would cross numerous ephemeral drainages in the Project Area. Most of these drainages are small erosion features that are less than 4 feet wide and tend to be shallow with depths ranging from 2 feet or less, to depths a little over 3 feet. These drainages are generally dry and only carry water during periods of heavy rainfall, most often associated with summer thunderstorms. There are no perennial or intermittent watercourses in the Project Area.

Under the Proposed Action, approximately 40.5 linear miles of drainages would be temporarily disturbed during construction activities (road construction, pipeline trenching, gen-tie line installation, solar field grading, and well drilling). Road construction and pipeline trenching would require crossings at approximately 27 mapped drainages, for a total drainage disturbance, of 0.9 linear mile. During road construction and pipeline trenching, 0.5 linear mile of drainages would be disturbed for temporary construction use corridors and reclaimed once the temporary use is concluded. Following reclamation in temporary construction use corridors, 0.4 linear mile of drainages would be permanently modified by the presence of culverts and/or crossings (permanent, operations related impacts are discussed in Section 4.18.1.3.2). Most (98%) drainages that would be disturbed by construction of the SSEP are located within the proposed solar field, where 39.6 linear miles of surface water drainages would be removed. Disturbance due to culverts and/or crossings in the well field would total less than 0.01 linear mile.

Assuming a drainage density of 0.012 linear mile per acre for the combined Rainbow Valley watershed and Waterman Wash watershed (Moody and Frazee 2009), the drainages that would be disturbed by construction of the SSEP represent approximately 1.1% of the total linear miles of drainages in these watersheds. A summary of the drainages removed or modified (by culverts and/or crossings) to construct each component of the SSEP under the Proposed Action is provided in Table 4.100.

Table 4.100 Construction-related Disturbances to Surface Water Drainages – Proposed Action

Disturbance	Area	Linear Miles
Drainage removal, culvert and crossing installation	Roads, pipelines, and gen-tie line	0.9
	Proposed solar field	39.6
	Well field	<0.01
	Total	**40.5**

The temporary disturbance of surface water drainages in the Project Area would result in trampled or removed vegetation, soil compaction (from construction equipment), and soil scarification and loosening. These disturbances would result in alterations to drainage form and function which would increase the risk of erosion and sediment transport in the event of an infrequent storm and runoff through the drainage. Construction activities within these drainages would be short term (persisting only for the necessary construction timeframe). All temporary drainage crossings would be restored at the completion of road, pipeline, and gen-tie line construction, and no changes in drainage patterns would be anticipated to occur due to these activities. Once the temporary use is concluded and the site is reclaimed, the risk of erosion and sediment transport would likely match that of the surrounding landscape, which is also prone to erosion due to its fine-grained alluvial soils and general lack of vegetation.

Floodplains are present in the proposed solar field, along Riggs Road, and the road to the well field. There are no FEMA-regulated floodplains in the Project Area. Under the Proposed Action, approximately 221.7 acres of floodplains would be temporarily disturbed during construction activities. Similar to drainages, most of the floodplains that would be disturbed during construction are located within the proposed solar field where 215 acres of floodplains would be permanently removed. Outside the proposed solar field, there are five floodplains with an area of 6 acres that would be disturbed during road improvements and pipeline trenching along Riggs Road. Three floodplains with an area of 0.7 acre are present within or directly adjacent to the proposed well field area. Some of these floodplains would be disturbed during road improvements made to the well field. A summary of the floodplains temporarily disturbed during construction of the SSEP is provided in Table 4.101.

Table 4.101 Construction-related Disturbances to Floodplains – Proposed Action

Disturbance	Area	Acres
Temporary	Roads and pipelines	6
	Proposed solar field	215
	Well field	0.7
	Total	**221.7**

Construction would result in trampled or removed vegetation, soil compaction (from construction equipment), and soil scarification and loosening. These disturbances would result in alterations to floodplain form and function such that there would be a loss of area for flood flows to disperse and infiltrate, which would increase the magnitude of downstream flooding in the event of a low-frequency (i.e., 50- or 100-year) flood event occurring during construction. Construction activities within these floodplains, and their attendant impacts as described above, would be localized and short term because they would occur over a limited land area according to the construction schedule and they would only persist for the duration of construction and rehabilitation immediately following construction.

Final engineering of the drainage plan for the site would involve hydrologic modeling to understand the pre-construction conditions and function of the floodplains. The floodplains would be hydraulically modeled using detailed methods and new 2-foot contour mapping. The USACE Hydrologic Engineering Centers River Analysis System (HEC-RAS) application (Version 4.0) would be used to estimate the flow depth and velocities within these floodplains. The modeling parameters that would be used in the HEC-RAS application include the hydrologic modeling results, Manning's n values, channel cross-section geometry, the channel slope, and the distance to the downstream reach. These parameters would be estimated from the existing topography for the Project Area and from field visits. If a more detailed analysis is required at any location, Flo-2D may be used to estimate the flow depths and velocities. This may be required at flow split locations or other locations that are difficult to model correctly with HEC-RAS. In addition to HEC-RAS and Flo-2D, Bentley's FlowMaster may be used to evaluate normal flow depths and velocities in channels and the Federal Highway Administration HY-8 Program may be used for detailed hydraulic calculations. The results from this modeling would be used to restore the floodplains to their pre-construction conditions. All floodplain disturbances outside the proposed solar field would be restored at the completion of road and pipeline construction, and no permanent changes in floodplain patterns would be anticipated to occur.

4.18.1.3.4 Surface Water Quantity

Changes in hydrology would increase slightly due to surface discharges of water used for hydrostatic testing, well development, and well testing. Under the Proposed Action, groundwater would be pumped from four production wells. One existing well (designated TW-1) is located in the well field for the SSEP and has been developed and tested. Three additional groundwater wells would be drilled. These additional wells would require development and testing. Well development involves the pumping of groundwater from the well to remove fine-grained sediments from the well and filter pack adjacent to the well screen until the water is relatively clear. Aquifer test pumping is also required to estimate the sustainable yield of the wells and evaluate aquifer hydrogeologic parameters. These aquifer tests are anticipated to involve step-rate tests and constant-rate tests.

To estimate the quantity of groundwater pumped and discharged to the surrounding area from well development and testing activities, the quantities of groundwater generated during well development and testing of the existing well (TW-1) were used. During well development of TW-1 approximately 81,000 gallons of water were produced (Carr 2010). During the step-rate test on TW-1, the well was pumped for five 2-hour intervals at rates averaging 793 gpm, 1,017 gpm, 1,210 gpm, 1,408 gpm, and 1,600 gpm, totaling 531,360 gallons. Aquifer testing of TW-1 consisted of a 72-hour, constant-rate aquifer test using an average pumping rate of approximately 1,400 gpm, totaling 6,048,000 gallons. Therefore, approximately 6,660,360 gallons of groundwater were pumped during well development and aquifer testing of TW-1. The groundwater produced during well development and aquifer testing of test well TW-1 was conveyed by a pipeline to a nearby wash approximately 1 mile west of TW-1 (Carr 2010). Prior to well development, ADEQ was notified by letter to ensure that the discharge would be covered under the AZPDES (personal communication, David A. Carr 2010).

Under the Proposed Action, it is assumed that well development and aquifer testing of the three additional groundwater wells would generate approximately 20 million gallons of groundwater. The future discharge location(s) for this water would be identified and permitted prior to beginning well development and well testing activities (personal communication, David A. Carr 2010).

The combined quantities of groundwater (20 million gallons from well installation and an unknown volume from hydrostatic testing) would be surface discharged within the Project Area and would result in a short-term increase in surface water flows. This increase in surface water flows would increase the risk of erosion and transport of suspended solids that would be deposited as sediment in drainages, washes and floodplains. However, these discharges would be localized and the discharge rates would be controlled.

Prior to well testing, Boulevard would notify ADEQ to ensure that the discharges would be covered under the AZPDES permit. The assumed maximum groundwater pump test rate of 1,400 gpm is roughly equivalent to a storm event of 3.1 cubic feet/second (cfs). Runoff from storm events in the Rainbow Valley Sub-basin ranged from 3.7 cfs to 1,827 cfs. The number of groundwater production wells proposed under other action alternatives is less than the Proposed Action. Therefore, changes in surface water quantities due to discharges of groundwater from well development and testing under other action alternatives would be less that under the Proposed Action and are not further addressed.

4.18.1.3.5 Impacts to Surface Water Resources during Operations

The impacts to surface water resources during operation and maintenance of the SSEP would be associated with 1) changes in surface water drainage patterns due to the installation of culverts and/or crossings; 2) permanent removal of drainages and floodplains in the proposed solar field; and 3) re-routing of stormwater in and around the proposed solar field. These changes to surface water resources are discussed below. The potential for contamination of surface waters during operation and maintenance of the SSEP are also discussed.

4.18.1.3.6 Water Quality

During operation and maintenance of the SSEP, changes in surface water quality would occur due to changes in the amount of suspended solids in surface waters that would run off from the proposed solar field during storm events. Under the Proposed Action, surface water runoff from precipitation on the proposed solar field would be collected in four stormwater sediment/detention basins in the proposed solar field. Suspended solids in surface water flows would settle out in these basins and deposit as sediments. The amount of sediment accumulated in these basins would be monitored and removed as needed. The removal of sediments from water released from the retention basins would decrease the suspended solids concentration in these waters. The reduction in suspended solids concentrations would

result in an increased risk in the erosion potential of waters released from the retention basins due to the decreased sediment load and increased sediment load capacity. This increase in load capacity could cause increased erosion downgradient of the proposed solar field. Furthermore, the location for disposal of the accumulated sediments, not currently stated, would affect the potential for change in water quality (for example, sediments disposed near drainages have a higher potential to be washed downstream during a storm event than if disposed away from drainages).

Impacts to surface water (contamination) during operation and maintenance would also result from accidental spills during the handling of stored hazardous chemicals and solid wastes. The SPP developed for the Proposed Action outlines spill prevention practices, emergency response and cleanup procedures, and storage protocols. These spill prevention and cleanup procedures would prevent surface water contamination so that the concentrations of these constituents in surface water would be within regulatory limits.

Because the proposed solar field would remain unpaved, a dust suppression coating would be used on dirt roadways in and around the solar field. In addition, herbicides would be used as needed to prevent vegetation establishment. The use of dust suppressants and herbicides would increase the risk of contamination to surface waters in the event that these chemicals are transported to surface waters and runoff from the Project Area. The risk of herbicide transport would be minimized by the stipulations of the required pesticide use permit. Typical requirements include minimizing application to the lowest effective level, the use of nonpersisting compounds that will break down before they can reach water, strict adherence to label directions, use of appropriate personal protective equipment, avoidance of use or storage near surface water, and mandatory application during periods of weather that minimize the risk of transport by precipitation. Adherence to such stipulations and BLM approval of a permit and vegetation management plan would greatly reduce the remote risk of herbicides being transported to surface waters, the nearest of which is typically the Gila River, located several miles away. Some herbicides can be toxic to aquatic life at certain concentrations. Because of the remote distance of surface waters supporting aquatic life, and the risk minimization through permit requirements and standard application practices, the risk of toxicity would be negligible.

4.18.1.3.7 Floodplains and Drainage

Under the Proposed Action, 12 permanent culverts would be installed along the access road alignment. In addition, there would be 15 permanent crossings in the well field. The culverts and crossing would be installed to mimic natural surface water flows, and therefore no changes to the function of these drainages would be expected to occur (WorleyParsons Group Inc. and Cardno WRG, Inc. 2011).

During operation of the SSEP, 40 linear miles of drainages would be permanently disturbed (removed or modified with culverts and crossings). Most of these drainages are located within the proposed solar field where 39.6 linear miles of surface water drainages would be permanently removed. The removal of these surface water drainages from within the solar field would result in the long-term alteration of surface flows in this area. Any runoff that previously flowed through these ephemeral drainages to receiving waters (the Gila River) would now either be 1) collected within detention basins in the solar field and released to surface waters slowly or 2) be diverted around the solar field via surface water drainage control structures (berms) constructed to prevent surface flows from entering the solar field area. Less than 0.01 linear mile of drainages would be disturbed in the well field by vehicle access to the wells. A summary of the drainages disturbed in each area of the SSEP is provided in Table 4.102.

Table 4.102 Operation-related Disturbances to Surface Water Drainages – Proposed Action

Disturbance	Area	Linear Mile(s)
Permanent (Modification to surface flows and an increased risk of erosion and downstream sedimentation as a result of blading and grading the solar field and installing drainage control structures)	Roads, pipelines, and gen-tie line	0.4
	Proposed solar field	39.6
	Well field	<0.01
	Total	**40.0**

The overall drainage concept for the Proposed Action is shown in Figure 2.9 and Map 7 (WorleyParsons Group, Inc. and Cardno WRG, Inc. 2010). As described in Section 2.5.2.8, stormwater generated on-site would be directed to stormwater detention basins and retained so that sediment settles out prior to the water being released to existing washes downstream of the Project Area. The detention basins would attenuate storm-event runoff from each solar field and release it to washes at or below the pre-developed 100-year, 24-hour storm-event flow rate. Therefore, there would not be any downstream habitat or physical changes associated with rerouting surface water because the hydrology would mimic natural flow patterns. Further, the design of the outfalls includes scour protection to further reduce erosion. As described in Section 2.5.2.7, off-site stormwater runoff would be collected and conveyed around the perimeter of the Project Area where it would be released back into the natural washes in a manner similar to the existing condition. Finally, because fences and other infrastructure would be designed to accommodate large flow events, they would not act as barriers or be threatened by large storms.

The permanent disturbance (culverts and crossings) of surface water drainages along roads would result in alterations to drainage form and geometry. However, once completed, surface water flow velocities and sediment load are expected to be the same as pre-construction conditions. These changes are expected to be minimal due to the installation of engineered culverts and crossings that would be designed to mimic the natural surface water flow velocities.

Long-term changes to surface water drainages would mainly occur in the proposed solar field where the drainages would be permanently removed and off-site stormwater would be routed around the solar field. These changes are expected to be minimal due to the planned engineered stormwater interceptor basin, conveyance diversion channels, and controlled release points. The permanent disturbance of surface water drainages in the proposed solar field would result in alterations to drainage form. However, no changes in drainage function in the proposed solar field would be anticipated to occur during operation of the SSEP.

Additionally, Boulevard would implement the applicant-committed environmental protection measures and BMPs during operation and maintenance of the SSEP, as presented in Chapter 2. For example:

> *Site Drainage and Runoff Control*–The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls (along with retention time) to reduce the peak off-site discharge and to match pre-development conditions. The road berm and collection channel system would also be constructed to provide site protection from stormwater runoff during a 100-year return storm event. The toe of the western protective berm slope may be armored with soil cement cover and riprap to provide for slope erosion protection during a heavy storm event. Erosion protection may be necessary along portions of the channel collection system, as identified in the hydraulic evaluation.

Floodplains are present in the proposed solar field, cross Riggs Road, and are present along the road to the well field. Under the Proposed Action, approximately 218.7 acres of these floodplains would be permanently disturbed during operation of the SSEP. Of the 219 acres, 3 acres are located along Riggs

Road where culverts and/or crossings would be required at five floodplain channels. Less than 1 acre of floodplains is present in the proposed well field, where the floodplains would require culverts and/or crossings. The floodplains in the proposed solar field would be permanently removed. Similar to drainages, most of the floodplains are located within the proposed solar field where 215 acres of floodplains would be permanently removed. A summary of the floodplains permanently disturbed during operation of the SSEP is provided in Table 4.103.

Table 4.103 Operation-related Disturbances to Floodplains – Proposed Action

Disturbance	Area	Acre(s)
Permanent	Roads, pipelines, and gen-tie line	3
	Proposed solar field	215
	Well field	0.7
	Total	**218.7**

The permanent disturbance of floodplains would result in alterations to floodplain form and function. The long-term changes to floodplains due to the presence of new roads and culverts and/or crossings would result in a slight modification of floodplain form; however, once completed, flood flow velocities and sediment load are expected to be the same as pre-construction conditions. These changes are expected to be minimal due to the installation of engineered culverts and crossings that would be designed to mimic the natural surface water flow/flood velocities. Therefore, no changes in floodplain function due to road construction or pipeline installation would be anticipated to occur during operation of the SSEP.

The permanent removal of floodplains in the proposed solar field would result in a loss of area for flood waters to disperse and infiltrate, which could increase the risk of downstream flooding in the event of low-frequency (i.e., 50- or 100- year) flood events. This risk would be addressed by the re-routing of surface water runoff around the proposed solar field and by the construction of diversion channels. The diverted water would then be released to existing washes through a series of controlled release points. The engineered release points would be sized to match existing condition flow rates as much as practicable. Hydrologic modeling done for the SSEP (Frazee and Moody 2010) indicates that post-construction peak discharges (100-year, 24-hour peak flows) would be less than or equal to pre-development flows in Waterman Wash, Rainbow Wash, and their unnamed tributaries. Watershed integrity would be maintained by configuring the stormwater interceptor and diversion channel system to segregate the natural flows contributing to Rainbow Wash and the unnamed tributary to Waterman Wash. Additionally, the proponent would implement the applicant-committed environmental protection measures and BMPs during operation and maintenance of the SSEP, as listed above for surface water flows and drainages. Therefore, the risk of downstream flooding from flood waters that would naturally flow across the proposed solar field would be reduced during operation of the SSEP.

4.18.1.4 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, groundwater consumptive rates would be reduced (see Section 4.18.2) along with a slight reduction in the total Project Area (9 acres). The reduction in the surface area of the SSEP under Alternative A would result from a reduction in the number of wells in the well field. The number of groundwater wells would be reduced from four under the Proposed Action to two under Alternative A. This reduction in the area of the SSEP under Alternative A compared to the Proposed Action would result in a slight decrease in the number of drainages and floodplains impacted under Alternative A. Impacts to surface water resources would be the same in nature under Alternative A and the Proposed Action. The extent of impacts would vary between these alternatives as a result of differences in acres of disturbance and groundwater pumping rates.

4.18.1.4.1 Impacts to Surface Water Resources during Construction

Under Alternative A, construction of the SSEP would be the same as under the Proposed Action, with the minor exceptions discussed below.

Under Alternative A, the number of drainages crossed by roads during construction would be reduced from 27 to 21, because two fewer well sites would be necessary. Therefore, under this alternative, the total linear miles of disturbed drainages in the Project Area would be reduced from 40.5 miles to 40.4 miles (a 0.2% reduction in linear miles of disturbed drainages compared to the Proposed Action). All other disturbances to drainages during construction would be the same as under the Proposed Action.

Under Alternative A, the disturbance to floodplains during construction would be reduced from 221.7 acres to 220.7 acres (a 0.5% reduction in floodplain acreage disturbed compared to the Proposed Action), because two fewer well sites would be necessary. The nature of impacts to floodplains would be the same under both alternatives.

4.18.1.4.2 Impacts to Surface Water Resources during Operation

Under Alternative A, potential changes to surface water resources during operation and maintenance of the SSEP would be the same as under the Proposed Action, with the minor exceptions discussed below.

Changes to surface water drainages for Alternative A would be the same as the Proposed Action. There would be fewer impacts to drainages due to six fewer crossings in the well field. All other disturbances to drainages during operation would be the same as under the Proposed Action.

Under Alternative A, the disturbance to floodplains during operation and maintenance of the SSEP would be reduced from 218.7 acres to 218.2 acres (a 0.2% reduction in floodplain acreage disturbed compared to the Proposed Action), because two fewer well sites would be necessary.

4.18.1.5 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, the total acres of permanent disturbance in the Project Area would be reduced from 3,589 acres under the Proposed Action to 1,984 acres. This equals a reduction in the permanent disturbance of Project Area of 1,605 acres (a 45% reduction). Most of this reduction is in the proposed solar field, which would be reduced from 3,528 acres to 2,306 acres (1,226 acres or 35% reduced area). Impacts to surface water resources under Sub-alternative A1 would be reduced due to a reduction in the number and miles of drainages and reduced acres of floodplains impacted. These changes and associated impacts are discussed below. The number of groundwater production wells would be reduced from four under the Proposed Action to two under Sub-alternative A1 (see Section 4.18.2).

4.18.1.5.1 Impacts to Surface Water Resources during Construction

Under Sub-alternative A1, the total acres of temporary disturbance in the Project Area would be reduced from 3,620 acres under the Proposed Action to 2,013 acres. This equals a reduction in the temporary disturbance of Project Area of 1,607 acres or 44%.

Under Sub-alternative A1, the number of drainages crossed by roads during construction would be reduced from 27 under the Proposed Action to 19, due to two fewer well sites. Therefore, under this alternative, the total linear miles of disturbed drainages during construction of the SSEP would be reduced from 40.5 linear miles to 20.1 linear miles (a 50% reduction compared to the Proposed Action) (Table 4.104). The nature of disturbances to drainages during construction would be the same as under the Proposed Action.

Table 4.104 Construction-related Disturbances to Surface Water Drainages – Sub-alternative A1

Disturbance	Area	Linear Mile(s)
		Sub-alternative A: Photovoltaic
Temporary	Roads, pipelines, and gen-tie line	0.69
	Proposed solar field	19.45
	Well field	0.001
	Total	**20.15**

Under Sub-alternative A1, disturbance to floodplains during construction would be reduced from 221.7 acres (Proposed Action) to 3.9 acres (98% reduction), because the Project Area under Sub-alternative A1 would occupy less land than the Proposed Action and would avoid most of the floodplains in the area. This alternative would also result in the elimination of floodplains disturbed in the well field (see Table 4.105).

Table 4.105 Construction-related Disturbances to Floodplains – Sub-alternative A1

Disturbance	Area	Acre(s)	
		Proposed Action	Sub-alternative A1: Photovoltaic
Temporary	Roads and pipelines	6	3.9
	Proposed solar field	215	0
	Well field	0.7	0
	Total	**221.7**	**3.9**

4.18.1.5.2 Impacts to Surface Water Resources during Operation

Under Sub-alternative A1, changes to surface water resources during operation and maintenance of the SSEP in the Rainbow Wash watershed would be the same as under the Proposed Action. The off-site drainage on the Waterman Wash side of the Project will remain in the natural washes and drainage paths.

Under Sub-alternative A1, the number of permanent culverts installed along the access road would be 13 compared to 12 under the Proposed Action (Map 7). Under the Proposed Action, this wash would fall inside the solar field, but under Sub-alternative A1, it would be outside the solar field and therefore crossed by the access road alignment. There would also be six permanent crossings in the well field. Under this alternative, the total linear miles of disturbed drainages during operation and maintenance of the SSEP would be reduced from 40.0 miles to 19.8 miles, a 50% reduction.

The long-term impacts to surface water drainages would be the same under Sub-alternative A1 as under the Proposed Action, although the impacts would apply to fewer miles of drainages.

Under Sub-alternative A1, 1.9 acres of disturbance to floodplains would occur during operation and maintenance of the SSEP. This is a 99% reduction compared to the Proposed Action (where 218.7 acres of disturbance to floodplains would occur). The reduction in acres of disturbance in floodplains under Sub-alternative A1 is due to the reduced footprint of the proposed solar field compared to the Proposed Action and the avoidance of most floodplains under this alternative.

4.18.1.6 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the total acres of permanent disturbance in the Project Area would be reduced from 3,589 acres under the Proposed Action to 2,363 acres. This equals a reduction in the permanent disturbance of Project Area of 1,226 acres (-34%). Most of this reduction is in the proposed solar field, which would be reduced from 3,528 acres to 2,306 acres (1,226 acres or 35% reduced area). Impacts to surface water resources under Alternative B would be reduced due to a reduction in the number and miles of drainages and reduced acres of floodplains impacted. These changes and associated impacts are discussed below. The number of groundwater production wells would be reduced from four under the Proposed Action to three under Alternative B (see Section 4.18.2).

4.18.1.6.1 Impacts to Surface Water Resources during Construction

Under Alternative B, the total acres of temporary disturbance in the Project Area would be reduced from 3,620 acres under the Proposed Action to 2,394 acres. This equals a reduction in the temporary disturbance of Project Area of 1,226 acres (-34%).

Under Alternative B, the number of drainages crossed by roads during construction would be reduced from 27 under the Proposed Action to 23, due to one fewer well site. Therefore, under this alternative, the total linear miles of disturbed drainages during construction of the SSEP would be reduced from 40.5 linear miles to 26.2 linear miles (a 35% reduction compared to the Proposed Action) (see Table 4.106). The nature of disturbances to drainages during construction would be the same as under the Proposed Action.

Table 4.106 Construction-related Disturbances to Surface Water Drainages – Alternative B

Disturbance	Area	Linear Mile(s)
		Alternative B: Reduced Footprint
Temporary	Roads, pipelines, and gen-tie line	0.9
	Proposed solar field	25.4
	Well field	0
	Total	**26.2**

Under Alternative B, disturbance to floodplains during construction would be reduced from 221.7 acres (Proposed Action) to 114.8 acres (48%) because the Project Area under Alternative B would occupy less land than the Proposed Action and therefore avoid disturbing 106.4 acres of floodplains. A small reduction (13%) in the change to floodplains would also occur along the well road (from 3.1 acres under the Proposed Action to 2.7 acres under Alternative B) (Table 4.107).

Table 4.107 Construction-related Disturbances to Floodplains – Alternative B

Disturbance	Area	Acre(s)	
		Proposed Action	Alternative B: Reduced Footprint
Temporary	Roads and pipelines	6	5.5
	Proposed solar field	215	108.6
	Well field	0.7	0.7
	Total	**221.7**	**114.8**

4.18.1.6.2 Impacts to Surface Water Resources during Operation

Under Alternative B, potential changes to surface water resources during operation and maintenance of the SSEP would be the same as under the Proposed Action.

Under Alternative B, the number of permanent culverts installed along the access road would be the same as under the Proposed Action. However, the number of permanent crossings in the well field would be reduced from 15 under the Proposed Action to 11, due to one less well site. Under this alternative, the total linear miles of disturbed drainages during operation and maintenance of the SSEP would be reduced from 40.0 miles to 25.8 miles (36%).

The long-term impacts to surface water drainages would be the same under Alternative B as under the Proposed Action, although the impacts would apply to fewer miles of drainages. There would be fewer impacts to drainages due to four less drainage crossings in the well field. All other disturbances to drainages during operation would be the same as under the Proposed Action.

Under Alternative B, 112 acres of disturbance to floodplains would occur during operation and maintenance of the SSEP. This is a 49% reduction compared to the Proposed Action (where 218.7 acres of disturbance to floodplains would occur). The reduction in acres of disturbance in floodplains under Alternative B is due to the reduced footprint of the proposed solar field compared to the Proposed Action.

4.18.1.7 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

The use of a brine concentrator to reduce SSEP water use would not affect the environmental consequences to surface water resources under either the Proposed Action or Alternative B.

4.18.1.8 GENERATION TIE LINE OPTION

The addition of the Gen-tie Line Option to the Proposed Action, Alternative A, or Alternative B would result in the additional disturbance of 809 feet of surface water drainages when compared to the proposed gen-tie line (Table 4.108). The location of culverts under this option would shift, and the number of culverts would increase from 12 to 22. Using a total of 40 miles or 211,200 feet for the Proposed Action disturbance, this represents a 0.4% increase in total surface disturbance. If the Gen-tie Line Option were implemented with Sub-alternative A1, an additional disturbance to surface water drainages of 836 feet would occur. Using a total of 104,652 linear feet for the Sub-alternative A1 disturbance, this represents a 0.8% increase in total surface disturbance.

Table 4.108 Additional Feet Disturbed with the Gen-tie Line Option

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Disturbance to Surface Water Drainages		
Temporary disturbance	581	581
Long-term disturbance	228	255
Total disturbance	**809**	**836**

No additional acres of disturbance to floodplains would occur if the Gen-tie Line Option were applied to any of the action alternatives.

4.18.1.9 POTENTIAL MITIGATION MEASURES

No potential mitigation measures are suggested.

4.18.1.10 RESIDUAL IMPACTS

Because no potential mitigation measures are suggested, the residual impacts to surface water would be the same as discussed under the Proposed Action and other action alternatives.

4.18.1.11 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The short-term use of the Project Area for constructing, operating, and maintaining the SSEP would have no impact on the long-term productivity of surface water resources as described above. Applicant-committed environmental protection measures, surface water control structures that mimic the outcomes of natural flow conditions, and BMPs would allow the quality and quantity of surface water to be maintained for the life of the project and beyond (following decommissioning). Short-term and long-term gains in productivity associated with the Proposed Action and other action alternatives would consist of improvements in the control of flood stage waters that flow through the proposed solar field, because these flows would be controlled by designed releases from the solar field.

4.18.1.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The applicant-committed measures listed in Chapter 2 (see Table 2.2) would require the reclamation of disturbed areas immediately following temporary disturbances and termination of the project. Long-term disturbance areas would constitute an irretrievable commitment of water resources until active site reclamation and restoration of drainages and floodplains is completed. Irretrievable commitments of water resources would include any permanently capped project areas, permanent culverts, and paved roadways associated with the Proposed Action and other action alternatives that would persist for the life of the project.

There would be an irretrievable loss of natural drainages and floodplains from the SSEP, because the proposed solar field would be graded, and those surface water features would be precluded for the life of the project. However, there would be no irreversible commitments of surface water resources, because the area would be reclaimed after termination of the project.

The SSEP would have relatively limited effects on surface water flows. All naturally occurring flows would pass largely unaffected to the downstream washes. Therefore, the SSEP would not result in any irreversible or irretrievable commitments of water resources with respect to surface water quantity.

4.18.2 Groundwater

4.18.2.1 ANALYSIS AREA AND ANALYSIS ASSUMPTIONS

Under the Proposed Action and other action alternatives, water required for the SSEP would be pumped from the Rainbow Valley aquifer in the Rainbow Valley Sub-basin of the Phoenix active management area. The analysis area used to evaluate the potential impacts to groundwater resources is the Rainbow Valley Sub-basin (Map 27).

The Proposed Action and other action alternatives would include removal of groundwater from the local Rainbow Valley aquifer at one well field located within the Project Area, east of the proposed solar field. The water would then be piped to the proposed solar field. Impacts from groundwater withdrawals are analyzed in terms of potential effects on the depth to groundwater (drawdown). Therefore, impacts to groundwater resources are measured by changes in groundwater levels and the associated changes in groundwater reserves stored in the Rainbow Valley aquifer.

Common to all groundwater pumping projects, groundwater pumping from a well causes groundwater to change flow directions within a portion of the aquifer, and groundwater within the influence of the pump flows toward the well. In an unconfined (water table) aquifer (e.g., the Rainbow Valley aquifer), as groundwater flows into the well, the water levels in the aquifer around the well are lowered (drawdown). The amount of groundwater drawdown is less with distance from the well, resulting in a conical-shaped depression radiating away from the well. This conical-shaped drawdown in groundwater levels is referred to as a cone of depression. The size and shape (slope) of the cone of depression depends on many factors, including the pumping rate and pumping duration. The primary potential impacts to water users in the Rainbow Valley Sub-basin would be increased depth to groundwater within the cone of depression. These increases in depth to groundwater would increase the risk to other groundwater users by requiring them to make adjustments in pump intake placement, and/or make upgrades to pumping equipment.

To evaluate changes in groundwater levels in the Rainbow Valley aquifer during operation of the SSEP, a groundwater flow model was developed by Carr (2010). This groundwater flow model simulated the effects on groundwater levels due to pumping groundwater at the rates anticipated for the Proposed Action. Therefore, the groundwater modeling results provided by Carr (2010) were used to quantify the drawdown in groundwater levels due to pumping from the Rainbow Valley aquifer for the SSEP. Changes in groundwater reserves stored in the Rainbow Valley aquifer were evaluated based on the proposed pumping rates and durations provided in the Proposed Action and other action alternatives.

Under the Proposed Action and other action alternatives, groundwater pumped from the Rainbow Valley aquifer is not expected to have a direct or indirect impact on surface water flows or resources in the Rainbow Valley Sub-basin. Locally, surface waters that flow in drainages and washes are only present after storm events. These short duration surface flows are not fed by groundwater, and no gaining streams are known to exist in the Rainbow Valley Sub-basin. In addition, flow rates in the Gila River are not expected to be impacted by groundwater pumping for the SSEP. The hydrologic disconnect between the Rainbow Valley aquifer and the Gila River is best shown by the results of a gravity survey conducted by Carr (2010). This gravity survey evaluated the depth to bedrock in a portion of the Rainbow Valley Sub-basin, and the results indicate the presence of a bedrock ridge located north of the Project Area. This bedrock ridge forms a no-flow boundary condition in the Rainbow Valley aquifer that separates the aquifer from the Gila River. Therefore, project-induced effects on local and regional groundwater levels

are not expected to impact surface flows in the Rainbow Valley Sub-basin or the Gila River and impacts to surface water flows due to groundwater pumping for the SSEP are not discussed further.

Under the Proposed Action and other action alternatives, recharge to the Rainbow Valley aquifer is not expected to be changed due to construction or operation of the SSEP. Natural groundwater recharge to the Rainbow Valley aquifer consists of mountain front recharge and stream channel recharge from flood-stage flows in Waterman Wash. Groundwater recharge near the SSEP is believed to be minimal due to the lack of a mountain front capable of providing recharge, lack of a primary stream channel, and significant evapotranspiration (Carr 2010).

The risk of land subsidence due to groundwater withdrawals is addressed qualitatively based on the proximity of areas with historic land subsidence, the rate of subsidence, and the hydrogeology of the Rainbow Valley aquifer. Areas east of the Project Area have subsidence features mapped by the Arizona Geologic Survey (Schumann and Genualdi 1986). These subsidence features are located approximately 1 mile east and 2 miles north of the proposed SSEP well field (see Map 10). The rate of subsidence in the Rainbow Valley Sub-basin is estimated to be 1 centimeter per year and is limited to small areas where agriculture is present (personal communication, Brian Conway 2010).

The potential for land subsidence due to groundwater pumping can increase depending on the hydrogeology of the aquifer. Interbedded aquifer-aquitard systems are more susceptible to compaction due to the compressibility of fine-grained sediments (clays and silts) that result in a lowering of the land surface (subsidence). In other words, if an aquifer consists of beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Golder (2009) notes three distinct hydrogeologic units in the exploratory borings: 1) an upper unit consisting of sand and gravel, 2) a middle unit consisting mainly of clay and silty clay, and 3) a lower, highly consolidated conglomerate (see the hydrogeologic cross-section from Carr 2010, Figure 20). The clay and silty clay unit extends from 920 feet to 1,100 feet below land surface and is referred to as an aquitard (Carr 2010). The screened interval in test well TW-1 extends from 519 to 919 feet below land surface. If other production wells extract water near the clay/silt aquitard, or if the aquitard pore pressure is reduced, land subsidence would occur. Groundwater pumping solely for the SSEP is not expected to have an impact on the valley fill alluvial deposits of the Rainbow Valley aquifer or contribute to land subsidence. Therefore, land subsidence due to groundwater pumping for the SSEP is not discussed further.

It is assumed that the risk of arsenic contamination to groundwater resources would be low under the Proposed Action and other action alternatives. Based on preliminary results, the maximum concentration of arsenic is approximately 0.012 ppm. Although the EPA drinking water quality standard is 0.010 ppm, industrial wastewater produced from water treatment would be cooled on-site in six evaporation ponds. According to Arizona's Aquifer Protection Program, these ponds are classified as categorical discharging facilities and would require an APP from ADEQ. The statutes requiring the APP dictate that the facility "be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology" (A.R.S. § 49-243.B.1). The SSEP evaporation ponds would be constructed to meet ADEQ's prescriptive requirements for process solution compounds. Each pond would have a double liner system consisting of two high-density polyethylene liners separated by a synthetic drainage geonet and a leachate collection and removal system. Other prescriptive elements would be designed to ensure that contamination from arsenic or other constituents of concern do not interact with groundwater resources; however, if deemed necessary by ADEQ, groundwater quality would be monitored on-site to ensure compliance with Arizona Water Quality Standards.

Construction and operation of the SSEP are not expected to change groundwater recharge rates. Groundwater recharge to the Rainbow Valley aquifer consists of infiltration from agricultural irrigation occurring primarily in the northern part of the sub-basin, mountain front recharge, and stream channel recharge from flood-stage flows in Waterman Wash (Carr 2010). Groundwater recharge near the SSEP is believed to be minimal due to the lack of agricultural irrigation, a primary stream channel or a mountain front capable of providing recharge, and significant evapotranspiration. Depth-to-groundwater data are limited for the Project Area; however, the average depth to groundwater across the SSEP is estimated to be greater than 300 feet below land surface (Carr 2010). Due to the arid desert environment in the greater Project Area, infrequent and low precipitation, and thickness of the unsaturated zone (300 feet) in the Project Area, no impacts to groundwater recharge resulting from construction or operation of the SSEP are anticipated.

No impacts to groundwater (except withdrawals during well development and well testing, which are discussed below) are expected to occur during construction of the SSEP; therefore, only groundwater impacts that would occur during operation and maintenance of the SSEP are evaluated. The following sections discuss the potential project-induced effects on local and regional groundwater levels.

4.18.2.2 NO ACTION

Under the No Action alternative, no changes in the depth to groundwater, or groundwater reserves stored in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.

4.18.2.3 PROPOSED ACTION

Under the Proposed Action, four groundwater wells would be constructed within the well field location. The average groundwater usage for the Proposed Action is estimated to range from 2,305 to 3,003 afy (equivalent to an average pumping rate of approximately 1,429 to 1,862 gpm) depending on the amount of thermal storage and gas co-firing used. An acre-foot is the quantity of water that would fill an area of 1 acre, 1 foot in depth. This quantity is equal to 325,851 gallons and is approximately equivalent to the annual water use of four people. The minimum groundwater use (1,429 gpm) assumes solar production only; the maximum groundwater use (1,862 gpm) assumes 25% power production from thermal storage and gas co-firing production.

Figure 4.5 shows the changes in depth to groundwater as modeled for the SSEP (Golder 2009b) for the Proposed Action. The short-term (5-year) changes in depth to groundwater due to pumping at the two proposed rates (1,429 gpm and 1,862 gpm) are shown. The long-term (30-year) changes in depth to groundwater due to pumping at the proposed rates are also shown.

Short-term changes in groundwater levels were simulated by modeling the water level drawdown from the SSEP groundwater production wells for the first five years of operation at 1,429 and 1,862 gpm. The predicted drawdowns at the end of the five-year simulation period for the proposed pump rates are shown on Figure 4.5. The modeling results for the five-year simulation show maximum drawdown at the well field of approximately 16 feet and 20 feet, respectively for 1,429 and 1,862 gpm. The maximum extent of the cone of depression for both proposed pump rates is based on the 2-foot drawdown contour that is located approximately 2.0–2.5 miles east, west, and north of the well field (Golder 2009b).

Long-term changes in groundwater levels were also simulated from pumping at the SSEP production wells for 30 years of operation at 1,429 and 1,862 gpm. The predicted drawdowns at the end of the 30-year simulation period for the proposed pump rates are shown on Figure 4.5. The modeling results for the 30-year simulation show maximum drawdown at the well field of approximately 32 feet and 44 feet, respectively for 1,429 and 1,862 gpm. The maximum extent of the cone of depression for both proposed pump rates is based on the 2-foot drawdown contour that is located approximately 7–8 miles southeast of the well field (Golder 2009b).

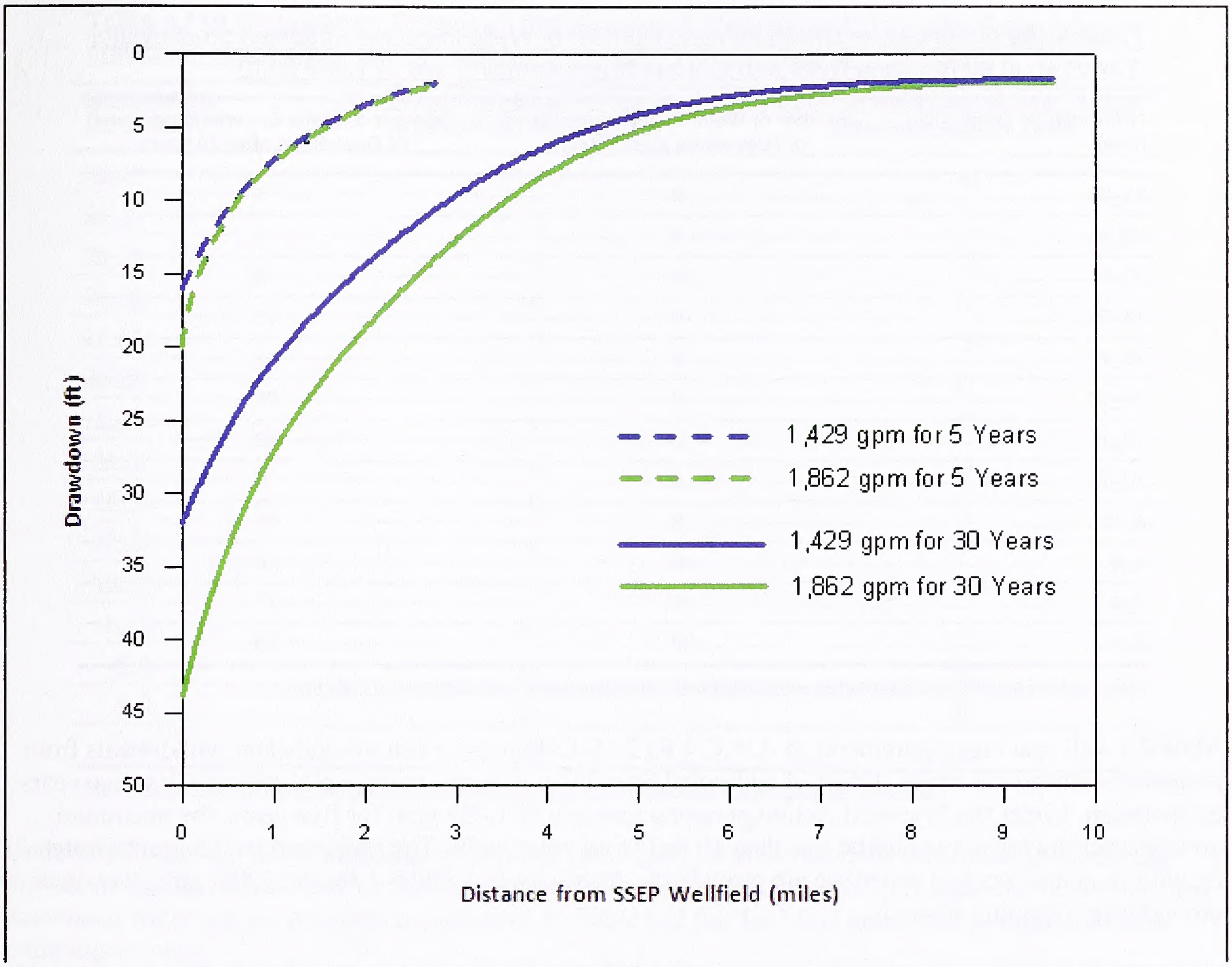

Figure 4.5 Groundwater level drawdown.

Short-term changes in groundwater levels due to groundwater pumping for the SSEP would cause an increase in the depth to water in registered wells. There are 355 registered wells in the Rainbow Valley Sub-basin. Under the Proposed Action pumping scenario of 1,429 gpm for five years, groundwater drawdown would occur in 79 registered wells. The amount of drawdown depends on the distance of the well from the SSEP well field and would range from 2 to 10 feet (Table 4.109).

Table 4.109 Groundwater Drawdown and Number of Wells Impacted (modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,429 gpm)

Groundwater Drawdown (feet)	Number of Wells Experiencing Level of Drawdown after 5 Years	Number of Wells Experiencing Level of Drawdown after 30 years
24–26	0	2
22–24	0	8
20–22	0	9
18–20	0	12
16–18	0	19
14–16	0	21
12–14	0	23
10–12	0	8
8–10	3	21
6–8	20	10
4–6	17	17
2–4	39	20

Note: Modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,429 gpm.

ADWR's well spacing requirements at A.A.C § R12-15-1302 require that groundwater withdrawals from proposed wells do not cause 10 feet of additional drawdown in surrounding wells after the first five years of operation. Under the Proposed Action pumping scenario of 1,429 gpm for five years, the maximum groundwater drawdown would be less than 10 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-1 for the 1,429 gpm, five-year groundwater pumping scenario.

Under the Proposed Action pumping scenario of 1,862 gpm for five years, groundwater drawdown would occur in 90 registered wells. The amount of drawdown under this scenario would range from 2 to 12 feet (Table 4.110).

Table 4.110 Groundwater Drawdown and Number of Wells Impacted (modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,862 gpm)

Groundwater Drawdown	Number of Wells Experiencing Level of Drawdown after 5 Years	Number of Wells Experiencing Level of Drawdown after 30 Years
30–32	0	8
28–30	0	7
26–28	0	4
24–26	0	12
22–24	0	9
20–22	0	21
18–20	0	12
16–18	0	11
14–16	0	15
12–14	0	10
10–12	6	16
8–10	15	7
6–8	15	10
4–6	17	20
2–4	37	14

Note: Modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of **1,862 gpm.**

Under the Proposed Action pumping scenario of 1,862 gpm for five years, the maximum groundwater drawdown would be less than 12 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-2 for the 1,862 gpm, five-year groundwater pumping scenario.

Under the 1,862-gpm groundwater pumping scenario, the groundwater level drawdown in six wells would be between 10 and 12 feet after five years of pumping. In accordance with ADWR's well spacing and well impact requirements, waivers would be required from the owners of these wells prior to groundwater pumping of the magnitude that would result in this level of drawdown. To determine the maximum short-term pump rate that would meet ADWR's well spacing and well impact requirements, Carr (2010) developed a pumping scenario that simulated a maximum 10 foot drawdown in other wells after five years of pumping. The results of this modeling scenario demonstrated that the maximum average annual pumping rate for the well field that meets ADWR's well spacing and well impact requirements is 1,600 gpm. Pumping at a rate in excess of 1,600 gpm would require waivers from the owners of any neighboring wells that could be impacted (i.e., see groundwater level drawdown greater than 10 feet after five years of pumping) as a result of SSEP groundwater pumping.

Long-term changes in groundwater levels were also simulated by Golder by modeling the drawdown due to pumping at the proposed rates of 1,492 gpm and 1,862 gpm for 30 years (the life of the project). Under the Proposed Action pumping scenario of 1,492 gpm for 30 years, the groundwater level in 170 registered wells would be drawn down from 2 to 26 feet.

The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-3 for the 1,492 gpm, 30-year groundwater pumping scenario.

Under the Proposed Action pumping scenario of 1,862 gpm for 30 years, the groundwater level in 176 registered wells would be drawn down. The amount of drawdown under this scenario would range from two to 34 feet (see Table 4.110).

Under the Proposed Action pumping scenario of 1,862 gpm for 30 years, the maximum groundwater drawdown would be less than 2 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-4 for the 1,862 gpm, 30-year groundwater pumping scenario.

Under the Proposed Action and other action alternatives, groundwater pumping from the Rainbow Valley aquifer would result in reductions in groundwater reserves stored in the Rainbow Valley aquifer for the life of the SSEP. These reductions are summarized in Table 4.111.

Table 4.111 Long-term Reductions in Groundwater Reserves

Action	Proposed Operational Pump Rate (gpm)	Proposed Operational Pump Rate (afy)	Reduction in Groundwater Reserves (acre-feet) for 30 years
Proposed Action	1,429	2,305	69,150
With gas co-firing	1,862	3,003	90,090
Alternative A: Reduced Water Use (dry-cooled CST)	72	116	3,480
With gas co-firing	94	151	4,530
Sub-alternative A1: Photovoltaic	20.5	33	2,165*
With gas co-firing	n/a	n/a	n/a
Alternative B: Reduced Footprint	941	1,518	45,540
With gas co-firing	1,242	2,003	60,090
Proposed Action with Brine Concentrator	1,329	2,144	64,320
With gas co-firing	1,732	2,793	83,790
Alternative B – Reduced Footprint with Brine Concentrator	875	1,412	42,360
With gas co-firing	1,155	1,863	55,890

Note: Calculated reductions in groundwater storage due to operational pumping for 30 years.

*The reduction in groundwater reserves for Sub-alternative A1 is based on 186–310 gpm pump rate for the first 3.25 years of construction, followed by 30 years of pumping at the operational rate of 20.5 gpm (33.25 years total).

4.18.2.3.1 Wells Impacts Analysis

Impacts to existing wells resulting from drawdown would primarily consist of the following effects: increased electrical power consumption, dewatering of well screen, and loss of sufficient hydraulic head above pump intake.

As water levels decline, the amount of electrical power required to pump groundwater to the surface would increase, increasing water production costs to the well owner. The degree of increase in pumping costs would be dependent on several factors, including the pump specifications, material of pipe, and electricity rates. Most domestic wells typically have a pump located near the bottom of the screened interval of the well. If the water levels decline to a level below the top of the screen, this would result in a

proportional decrease in well yield, potentially reducing the operational life of the well. The most severe impact to an individual well would be a declining water level to an elevation that is below the pump intake. In this case, it would be necessary to lower the pump further into the screened portion of the well, if possible. If the pump could not be lowered any further, the well would become inoperable as long as the water level was below the pump intake.

Approximately one-half of the wells in the northern part of Rainbow Valley are domestic and/or livestock wells, approximately one-fourth are irrigation wells, and the remaining one-fourth fall into other categories such as industrial supply, groundwater monitoring, or testing (Golder 2011). Most of the domestic/livestock wells range in depth from approximately 200 to 600 feet below land surface (bls), whereas most irrigation wells range in depth from approximately 600 to 1,200 feet bls. For this reason, domestic/livestock wells would be more likely than irrigation wells to be impacted by the regional water level decline rate as well as future water level declines related to residential development, agricultural activity, or the SSEP.

In general, wells that are located closest to the SSEP would be more likely to be impacted by SSEP-related water level drawdown than wells located several miles away. According to the Well Registry Database (ADWR 2009b), there are approximately 30 existing wells located within an approximately 1-mile radius of the proposed SSEP well field. All of these wells are small diameter (4–8 inches), low-capacity wells that have been registered with ADWR solely for domestic use, or for domestic use and livestock watering. The wells range in depth from 390 to approximately 670 feet bls; the average depth to groundwater in the area is approximately 360 feet bls.

Based on groundwater modeling results (Carr 2010), potential impacts to wells in the surrounding area would likely consist solely of additional electricity for groundwater pumping from a deeper level.

The percent reduction in groundwater reserves due to pumping for the SSEP is difficult to quantify because the existing reserves in the Rainbow Valley Sub-basin have not been estimated. The following sections discuss the various groundwater consumption rates and groundwater drawdown for the other action alternatives.

4.18.2.4 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, the average groundwater usage is estimated to range from 116 to 151 afy (72 to 94 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (72 gpm) assumes solar production only; the maximum groundwater use (94 gpm) assumes solar and gas co-firing production. Under this alternative, groundwater consumption would be approximately 90% less than under the Proposed Action. Two groundwater extraction wells would be constructed instead of four under the Proposed Action.

Because impacts would be within the range considered under other model scenarios (the Proposed Action and the No Action cumulative cases, see Appendix F and G), groundwater modeling was not conducted for the pumping rates proposed under Alternative A. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified in this analysis. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. Although a direct correlation is not possible, drawdown under this alternative would be expected to be much closer to the No Action alternative than to the Proposed Action (due to Alternative A's approximately 90% reduction in pumping rates relative to the Proposed Action).

Under the proposed pumping rate for Alternative A of 72 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 1,135 million gallons (Mgals) for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate under Alternative A of 94 gpm,

the reduction in stored groundwater in the Rainbow Valley aquifer would be 1,482 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the project.

4.18.2.5 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Sub-alternative A1 would result in the lowest amount of groundwater usage of all the action alternatives. Groundwater usage would range from 300 to 500 afy (186 to 310 gpm) during construction and would be approximately 33 afy (20.5gpm) during operation. Operational uses of water under this sub-alternative would include PV panel washing, dust control, and potable uses. Operational groundwater use under this sub-alternative would be less than 1.5% of the groundwater use under the Proposed Action. When calculated over the life of the project with construction and operational use factored in, the average annual water use would be 65 afy. Two groundwater wells would be constructed under this alternative, as opposed to four under the Proposed Alternative. Groundwater pumping would be pumped from one well at a time, and would alternate between the two wells.

As under the other action alternatives, long-term changes in groundwater levels after five and 30 years were simulated under Sub-alternative A1, but assumed an operational pumping rate of 20.5 gpm. Under this sub-alternative, predicted drawdown at the well field after 30 years would be approximately 0.7 foot, which represents approximately 1.0% of the cumulative drawdown.

Short-term changes in groundwater levels were simulated assuming a pumping rate of 310 gpm for the first year of construction, 186 gpm for the next 27 months, and at the operational rate of 20.5 gpm for the remaining five years (21 months). Under this sub-alternative, the predicted drawdown at the well field after five years would be approximately 0.8 foot. The drawdown after five years would be greater than the drawdown after 30 years because of the higher pumping rates during the construction phase of the project.

These predicted levels of drawdown would be in compliance with ADWR's A.A.C § R12-15-1302 well spacing requirements that require groundwater withdrawals from proposed wells not to cause 10 feet of additional drawdown in surrounding wells after the first five years of operation. Under Sub-alternative A1, the maximum groundwater drawdown would be less than 1 foot in all other wells. Of the 355 registered wells in the Rainbow Valley Sub-basin, none are expected to experience a drawdown greater than 1 foot after five years, nor after 30 years.

Under Sub-alternative A1, groundwater reserves stored in the Rainbow Valley aquifer would be reduced by approximately 2,165 acre-feet over the life of the SSEP (see Table 4.111).

Under Sub-alternative A1, even the wells located closest to the SSEP well field would likely experience drawdown of less than 1 foot and would therefore experience no detectable impacts.

4.18.2.6 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the average groundwater usage is estimated to range from 1,518 to 2,003 afy (941 to 1,242 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (941 gpm) assumes solar production only; the maximum groundwater use (1,242 gpm) assumes solar and gas co-firing production. Under this alternative, groundwater consumption would be approximately 30% less than under the Proposed Action. Three groundwater extraction wells would be constructed instead of four as under the Proposed Action.

Because impacts would be within the range considered under other model scenarios (the Proposed Action and the No Action cumulative cases, see Appendix F and G), groundwater modeling was not conducted

for the pumping rates proposed under Alternative B. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified in this analysis. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. Although a direct correlation is not possible, drawdown under this alternative would be expected to be closer to the Proposed Action than to the No Action (due to Alternative B's approximately 30% reduction in pumping rates relative to the Proposed Action).

Under the proposed pumping rate for Alternative B of 941 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 14,838 Mgals for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate under Alternative B of 1,242 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 19,584 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the project.

4.18.2.7 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

This option applies to either the Proposed Action or Alternative B and would reduce groundwater consumption by approximately 7% compared to the level of groundwater consumption that would occur under either of these alternatives. Therefore, under the Proposed Action the average groundwater usage is estimated to range from 1,412 to 1,863 afy (875 to 1,155 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (875 gpm) assumes solar production only, the maximum groundwater use (1,155 gpm) assumes solar and gas co-firing production. It is assumed that the number of extraction wells would be three or four.

Groundwater modeling was not conducted for the pumping rates proposed under this option. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project.

Under the proposed pumping rate for this option of 875 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 13,797 Mgals for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate of 1,155 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 18,212 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the SSEP project.

4.18.2.8 GENERATION TIE LINE OPTION

The addition of the Gen-tie Line Option to any of the action alternatives would not change impacts to groundwater resources because groundwater withdrawals under the Gen-tie Line Option would be the same as described above under the analysis of the alternatives. Likewise, the implementation of the Gen-tie Option would not influence natural groundwater recharge.

4.18.2.9 POTENTIAL MITIGATION MEASURES

No mitigation measures are suggested to further reduce groundwater drawdown.

4.18.2.10 RESIDUAL IMPACTS

Because no potential mitigation measures are suggested, the residual impacts to groundwater resources would be the same as discussed under the Proposed Action and other action alternatives.

4.18.2.11 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The short-term use of water resources for the SSEP would result in a long-term (but not permanent) impact on the productivity of the groundwater resources in the Rainbow Valley Sub-basin. Under the groundwater consumption scenarios described above, groundwater drawdown (due to the SSEP) over the 30 year life of the project would range from approximately 0.7 feet–34 feet. At project decommissioning groundwater consumption would cease. However, groundwater levels would be reduced by 2 feet to 34 feet until natural groundwater recharge replenishes the groundwater resource in the area. The groundwater recharge rate in the Rainbow Valley Sub-basin is estimated at 2,550 afy (Carr 2010). Reductions (i.e., groundwater level drawdown) in the long-term productivity of the groundwater resources in the Rainbow Valley Sub-basin due to the SSEP would therefore be limited to up to 25 years following project decommissioning and the cessation of project related groundwater use. Cumulative impacts to groundwater, including other projects, are discussed in Section 4.20.4.17, below.

4.18.2.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. This change in groundwater levels would be an irretrievable impact because groundwater levels would be lowered until natural recharge replenishes the aquifer. The quantities of groundwater needed to operate the SSEP would almost all be evaporated rather than discharged back to surface or groundwater and would be considered irretrievably consumed from the Rainbow Valley aquifer. However, the groundwater consumed by SSEP would not be irreversible. Groundwater withdrawals from the Rainbow Valley aquifer would cease immediately and concurrently with retirement of the SSEP. As a result, groundwater levels in the Rainbow Valley aquifer would recover following SSEP retirement.

Natural recharge to the Rainbow Valley aquifer consists of mountain front recharge and steam channel recharge. Carr (2010) estimated recharge to the Rainbow Valley aquifer as 2,550 afy. This estimate includes mountain front recharge and stream channel recharge from flood-stage flows in Waterman Wash. Assuming a natural, and constant, recharge rate of 2,550 afy, the recharge recovery time for SSEP withdrawls from the Rainbow Valley aquifer can be estimated as shown in Table 4.112).

Table 4.112 Long-term Groundwater Recharge Recovery of SSEP Withdrawals

Action	Proposed Operational Pump Rate (gpm)	Proposed Pump Rate (afy)	Reduction in Groundwater Reserves (acre-feet) for 30 years	Aquifer Recovery Time Year(s)
Proposed Action	1,429	2,305	69,150	27
With gas co-firing	1,862	3,003	90,090	35
Alternative A: Reduced Water Use (dry-cooled CST)	72	116	3,480	1
With gas co-firing	94	151	4,530	2
Sub-alternative A1: Photovoltaic	20.5	33	2.125*	1
With gas co-firing	n/a	n/a	n/a	n/a
Alternative B: Reduced Footprint	941	1,518	45,540	18
With gas co-firing	1,242	2,003	60,090	24
Proposed Action with Brine Concentrator	1,329	2,144	64,320	25
With gas co-firing	1,732	2,793	83,790	33
Alternative B: Reduced Footprint with Brine Concentrator	875	1,412	42,360	17
With gas co-firing	1,155	1,863	55,890	21

*The reduction in groundwater reserves for Sub-alternative A1 is based on 186–310 gpm pump rate for the first 3.25 years of construction, followed by 30 years of pumping at the operational rate of 20.5 gpm (33.25 years total).

Based on the above assumptions, under the Proposed Action, groundwater levels would recover to their pre-SSEP condition after 27–35 years, assuming no other withdrawals in the area. Under Alternative A, groundwater levels would recover in approximately one to two years. Under Alternative B, groundwater levels would recover in about 18 to 24 years. Under the Proposed Action with the brine concentrator applied and under Alternative B with the brine concentrator applied, groundwater levels would recover in approximately 25–33 years and 17–21 years, respectively. Finally, under Sub-alternative A1, water levels would recover from SSEP withdrawals after approximately 1 year.

4.19 Wildlife and Special-status Species

4.19.1 Analysis Area and Analysis Assumptions

The area of analysis for wildlife resources consists of the Project Area (see Section 3.19.1) and includes portions of the Buckeye Hills and the North Maricopa Mountains, including the northern portion of the Sonoran Desert National Monument. The analysis area includes these hills and mountains because certain wildlife species may pass through the Project Area while in transit between these areas. The analysis area also includes portions of the Gila River, Rainbow Wash, and an unnamed tributary to Waterman Wash, all of which are within 2 miles of the Project Area. Wash habitat is included in the analysis area due to its potential for wildlife species richness and its potential for use as wildlife travel corridors.

This impacts analysis for wildlife and special-status species takes into account the implementation of the applicant-committed measures described in Section 2.3.3.

The ESA of 1973 directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. The BLM has initiated informal consultation with USFWS for the SSEP. A BA has been prepared for the SSEP and has determined that there would not be any project-related impacts to any federally listed species and/or their designated critical habitat, because suitable foraging and/or breeding habitat is not present in the Project Area (EPG 2009). The USFWS has provided concurrence for this determination (USFWS 2010).

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell most birds listed under the act. The requirements under this act would be followed during all project phases. Mitigation measures are proposed in Section 4.19.5 to ensure compliance with this act.

Special-status wildlife species are designated by the BLM LSFO (sensitive), AZGFD (species of special concern), and USFWS (birds of conservation concern). Special-status species under each designation are managed so as not to become federally listed. Effects of this project on special-status species are analyzed in this section. Additional species-specific mitigation measures to lessen adverse impacts on these special-status species are considered in Section 4.19.5.

Wildlife habitat is defined by the presence or absence of a species in an area within a particular vegetation community type or using a particular resource (e.g., water). Because the presence of wildlife species is so closely tied to the presence and quality of a vegetation community or resource, the analysis of impacts to wildlife is measured in the following ways: acres of vegetation lost or degraded and the percent of the width of each linkage lost or degraded. The acreage of a vegetation community that is lost or degraded describes the type of habitat that is lost. This number is used when in reference to wildlife to describe an area in which animals would be displaced or otherwise affected, and to compare these areas among alternatives. Because the discussion in this section focuses on impacts to wildlife species, although referring to specific vegetation community types, impacts will be discussed in regard to wildlife habitat.

Additional analysis assumptions focus on wildlife responses to human-made noise, including vehicle noise. In general, animals can learn to react to noise with three response types: avoidance, attraction, and habituation (Bowles 1995; Knight and Temple 1995). Avoidance is defined as an animal staying away from an area because of negative or painful associations (e.g., hazing or injury). Attraction is defined as the strengthening of an animal's behavior because of rewards or reinforcements (e.g., feeding). Finally, habituation is defined as the waning of an animal's response to a repeated stimulus (Knight and Temple 1995). The response of each individual animal is derived from "the result of the number and outcome of interactions between an individual and its environment over the individual's lifetime" (Knight and

Temple 1995). Furthermore, the type of response elicited from wildlife may also be influenced by a range of other factors, including the source, type, degree, and duration of the disturbance. Nonlearned responses are referred to as "genetic responses". Genetic responses are those that have evolved in wildlife as instinct, such as defense and predator avoidance responses, and may also influence how an animal responds to a disturbance. For the purposes of this analysis, it is assumed that an animal may respond to a stimulus with avoidance, attraction, or habituation. In particular, an animal may habituate to a nonthreatening and nonattractive stimulus. However, because of the variety of factors that influences the way in which any individual animal responds, this analysis does not attempt to predict which animals will respond in which way.

The presence of human noise and activity has been shown to affect wildlife behavior. This research has typically been conducted by identifying the impacts of recreation on wildlife, focusing on impacts of human presence and differentiating between motorized and nonmotorized types of recreation (Knight and Cole 1995b; Taylor and Knight 2003). Studies have shown that wildlife can be negatively impacted by human-produced noises, and that the intensity of impacts depends on the timing, frequency and magnitude, and predictability of the disturbances. Negative impacts consist of modified behavior, which can alter the animal's vigor (e.g., increase stress levels) and productivity (especially if disturbed during critical times of year such as breeding and wintering) (Gabrielsen and Smith 1995; Knight and Cole 1995a). If the disturbance persists, wildlife populations can ultimately be negatively impacted by a change in distribution (avoidance, abandonment of preferred areas), a reduction in population size, or a shift in the population demographics (Knight and Cole 1995b). These responses vary by animal type and species, group size, age, and sex (Knight and Cole 1995a). For the purpose of this analysis, it is assumed that the presence of human noise and activity constitutes a negative impact on wildlife, and that the magnitude of the impact is directly correlated with the timing, duration, volume, and predictability of the produced noise and activity.

Vehicle noise is discussed throughout this section because it is representative of decreased wildlife habitat quality near roads. Studies have shown that effects on wildlife from vehicle noise are proportionate to both the volume of traffic on roads and the speed the cars are traveling (Reijnen et al. 1995; Reijnen et al. 1996). Additionally, the distance from the road at which the animal feels the impact increases with traffic volume (Forman and Alexander 1998). For the purposes of this analysis, it is assumed that wildlife incur more negative effects of vehicle noise at greater distances from the roads with increased traffic volume and speeds. Wildlife can respond to reduced habitat quality near roads in two ways: numerically, such as a decrease in abundance or density of breeding individuals, or behaviorally, such as road avoidance (Forman et al. 2003). The reasons for these responses to vehicle noise include hearing loss and sensitivities to frequencies that humans cannot hear, an increase in stress hormones, altered behaviors, interference with communication during breeding activities, and increased home range size (due to decreased habitat quality) leading to decreased density of the breeding population (Forman and Alexander 1998; Larkin 1996; Reijnen et al. 1996). Additionally, predator populations are negatively impacted when prey populations decrease due to vehicle disturbance. Many of these effects, with increased intensity and duration, can lead to decreased reproductive success and ultimately affect local wildlife populations (Knight and Cole 1995b; Larkin 1996). The wildlife group most sensitive to noise disturbance is songbirds, which show impacts to breeding populations beginning at approximately 42 dB, which is less than the sound of human conversation at normal levels (Reijnen et al. 1996). Wildlife groups that are most impacted by vehicle disturbance include small mammals, forest and grassland birds, and large mammals (Forman and Alexander 1998).

Activity during construction includes both human noise and activity as well as vehicle noise. Vehicle noise during construction would be louder than during maintenance activities because more heavy equipment would be used. Impacts that would occur to wildlife during construction would be a combination of the impacts described above for human noise and activity and vehicle noise.

4.19.2 General Wildlife

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash series (Brown 1994). The plant species and structure of these communities is described in section 3.16.3 (Vegetation Communities). Each vegetation community provides habitat for a suite of wildlife species in various ways (described below). Because the discussion in this section focuses on impacts to wildlife species, although referring to specific vegetation community types, impacts will be discussed in regard to wildlife habitat.

Tables 4.113 and 4.114 display the acres and/or linear feet of each wildlife habitat type that would be removed under each alternative. Permanent-use vegetation removal would occur as a result of project construction, operations, and maintenance within the solar field footprint; new and improved roads; water well sites; and the gen-tie power line. Permanent disturbances would eliminate wildlife habitat from use in the long-term (greater than five years) because these areas would be converted to an industrial landscape. These areas would be fenced (solar field) or paved (roads) making them either inaccessible to or unsuitable as wildlife habitat.

Temporary vegetation removal would occur at access road locations for the gen-tie power line, buried gas pipelines, and temporary access road improvements. Temporary vegetation removal would be reclaimed within the short term (less than five years), and would be returned to as close to their pre-construction conditions as possible (see Table 2.2 Applicant-committed Environmental Protection Measures). These areas would be used by certain wildlife species after reclamation. The vegetation communities in Tables 4.113 and 4.114 are described in detail in Section 3.16. Acres of additional habitat disturbance associated with the Gen-tie Line Option are described in detail in Section 4.16.2.7 (Generation Tie Line Option).

Table 4.113 Acres of Wildlife Habitat Removed or Disturbed in the Sonoran Creosotebush-Bursage Scrub Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Permanent use	0	3,568.8	3,561.2	1,983.7	2,343.4
Temporary use	0	31.0	29.0	29.3	30.3
Total Disturbance	**0**	**3,599.8**	**3,590.2**	**2,013.0**	**2,373.7**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for the Proposed Action with brine concentrator option and Alternative B with the brine concentrator option.

Table 4.114 Linear Feet of Wildlife Habitat Removed or Disturbed in the Xeroriparian Wash Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	38,342.0	38,295.7	22,237.0	21,939.8
Temporary use	0	197.8	182.4	223.9	182.4
Total Disturbance	**0**	**38,539.8**	**38,478.1**	**22,460.9**	**22,122.2**

Note: Linear feet of disturbance do not include existing road surfaces.

*Linear feet of disturbance would be the same for the proposed action with brine concentrator option and alternative b with brine concentrator option.

The Sonoran Creotsotebush-Bursage Scrub community functions as breeding, foraging, cover, and movement habitat for many wildlife species. This community is breeding habitat primarily for medium to small-sized mammals and for reptiles and amphibians. Examples of species that use this vegetation community for breeding include the kit fox, coyote, badger, desert cottontail, desert pocket mouse, rock pocket mouse, woodrat, and various lizard species. This vegetation community is also used by wildlife as habitat for foraging (finding food), and cover (for hiding and heat retention). Many migratory bird and raptor species use the Sonoran Creotsotebush-Bursage Scrub community for these purposes, including the turkey vulture, red-tailed hawk, northern flicker, ash-throated flycatcher, cactus wren, and canyon towhee, as well as the breeding species listed above. Some wildlife species use this vegetation community primarily as habitat to move between habitat patches that may be more suitable for breeding or foraging activities. The bighorn sheep uses the Sonoran Creotsotebush-Bursage Scrub community for this purpose.

The ecological functions of the Xeroriparian Wash vegetation community are similar to the Sonoran Creotsotebush-Bursage Scrub community. However, this community may have disproportionately higher use by many resident and migratory birds for breeding, cover, perching, and foraging when compared to the Creotsotebush-Bursage Scrub community. In addition, many small mammals that use seeds from palo verde, mesquite, and other shrubs that occur within the Xeroriparian Wash vegetation community may be found in higher proportions in this habitat type. Another important difference is the potential for wash habitat to be used as a movement corridor. Species that rely on the use of this vegetation community as a movement corridor are mainly highly mobile big game species, and include the mule deer, mountain lion, and javelina.

A more detailed discussion of wildlife species associated with these vegetation communities can be found in Section 3.19.4.

4.19.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and the existing land uses would continue. These land uses include cattle grazing and dispersed recreation use (both motorized and nonmotorized).

Impacts to wildlife species from livestock grazing consist primarily of habitat competition, habitat modification, and soil compaction. Cattle compete for habitat by using the same food resources and occupying nesting habitat. Additionally, cattle may trample and collapse underground dens and burrows of fossorial species such as the kit fox and badger. Areas attractive to cattle (such as xeroriparian habitats and shaded areas) could result in compacted soils. Compacted soils are difficult to dig, and are therefore unsuitable for burrowing animals. If these disturbances happened repeatedly, wildlife could be displaced from suitable habitat into poorer quality habitat. Ultimately, population levels would decline due to a lack of suitable habitat. However, due to the ephemeral nature of the current grazing in the allotments in the analysis area and its adherence to the BLM's Rangeland Health Standards, the effects on wildlife described above would likely be minimal.

The Project Area contains approximately 7.4 miles of primitive routes. Wildlife habitat is impacted by motorized use of these routes in several ways, including fragmentation of habitat, disruption and displacement of wildlife from preferred habitat by vehicle noise, and wildlife mortality from collisions with vehicles. The fragmentation of habitat due to roads would disrupt wildlife movement and dispersal, resulting in altered population dynamics. Wildlife would respond to vehicle noise in the ways described in Section 4.19.1 (Analysis Area and Analysis Assumptions). Finally, motor vehicle use increases the risk of collisions and wildlife mortality. Nonmotorized use of the Project Area would affect wildlife behavior in ways similar to those described for motorized use, but typically with less intensity. Habitat fragmentation and disruption and displacement of wildlife from human noise are the main effects of nonmotorized use.

Due to the low levels of current motorized and nonmotorized use in the Project Area, the impacts described above would likely be infrequent and would not adversely affect wildlife populations.

Under the No Action alternative, wildlife species that are currently in the Project Area would continue to use the habitat. Infrequent disturbance would persist under this alternative in the form of livestock grazing and motor vehicle use. The adverse impacts described above would continue to affect wildlife individuals, but populations would remain unaffected.

4.19.2.2 PROPOSED ACTION

Activities associated with the Proposed Action are described in detail in Chapter 2 of this document. The project footprint under the Proposed Action includes a solar field, improved and new roads, a power line (gen-tie line), water pipelines, and four well sites. Evaporation ponds, land-treatment units, power blocks, and stormwater detention basins would all be located within the solar field footprint, which would be surrounded by perimeter fencing.

Wildlife species described in Section 3.19.4 would be adversely affected in several ways by the Proposed Action. These effects include displacement, habitat degradation, habitat fragmentation and road barrier effects, an increased risk of exposure to potentially toxic constituents in evaporative ponds, an increased risk of electrocution from power lines, and loss of ephemeral water source and breeding habitat through removal of a stock pond.

As displayed in Table 4.113, the Proposed Action would result in the permanent removal of 3,568.8 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community, and the temporary removal (pending rehabilitation) of 31 acres of wildlife habitat in the same vegetation community. It would also result in the permanent removal of 38,342 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community and the removal of 197.8 linear feet of Xeroriparian Wash vegetation community for temporary use (see Table 4.114).

The permanent removal of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community and its conversion into a landscape unsuitable for wildlife would displace wildlife individuals. This would impact wildlife that currently use this habitat for breeding, cover, foraging, and movement, such as those described above (Section 4.19.2). These individuals would be either forced into adjacent habitat that may be less suitable, or forced to travel long distances to find suitable habitat. Adjacent habitat may be less suitable because breeding territories may already be established and defended by other individuals, good breeding and nesting sites may already be occupied, and food resources may be at a carrying capacity to maintain current population levels and may not be able to accommodate growth. The displacement of wildlife individuals into less suitable habitat may lead to a reduced body condition of individuals, which would ultimately affect population health. The removal of this wildlife habitat for temporary uses would have the same effect on wildlife individuals as permanent removal of vegetation. Vegetation reclamation would begin after construction is complete and temporary use areas are no longer necessary. Due to the slow growing vegetation of the Sonoran Desert, these areas may not resemble pre-construction habitat in the short term (5 years), and displacement effects may persist into the long term. Vegetation reclamation is further discussed in Section 4.16.1. Once successful reclamation is accomplished wildlife species may return to the area.

Wildlife habitat in the Xeroriparian Wash community would be removed and replaced with a stormwater channeling system designed to divert water around the Project Area. Wildlife species that use the wildlife habitat in this vegetation community for cover and forage (migratory birds and raptors, reptiles, amphibians) would be forced out of this area and into adjacent upland habitat. Movement patterns would be altered for highly mobile big game species, such as the mule deer, mountain lion, and javelina. Individuals of these species would be forced to walk around the fenced solar field, which may affect individual stress levels because of increased exposure to human noise and activity, as described in Section 4.19.1 (Analysis Area and

Analysis Assumptions). If these individuals parallel the perimeter fencing while searching for suitable habitat, they would be funneled to the access roads to either the east or south of the solar field and would be exposed to the road impacts discussed below. Because the Xeroriparian Community would be permanently eliminated and wildlife would be excluded from the solar field, impacts to wildlife would be long term and would persist for the life of the project. Impacts from the removal of wildlife habitat for temporary uses would persist into the long term because of the slow rate of vegetative growth of the Sonoran desert. Typical wildlife use may resume after successful vegetation reclamation is accomplished.

SSEP construction activities would degrade wildlife habitat in areas within and immediately adjacent to the Project Area by introducing increased amounts of human noise and activity. Although construction noise would displace many wildlife individuals from an area surrounding the Project Area, this impact would be short term. Under the Proposed Action and during construction, daily peak hour vehicle trips are projected at 1,000 vehicles both during peak morning hours and again at peak evening hours during construction (Table 2.15, Comparison of Alternatives). This rate of vehicle use represents a proportion of the amount of human noise and activity on-site, because carpooling is expected. Also, construction activities include the use of loud vehicles, such as heavy machinery. In the long term, 46 vehicles would be expected to enter and exit the project site during peak hours, resulting in far less human noise and activity than during the construction phase, but more than under the No Action alternative. Although some vehicle use would occur during facility operation, minimal use of heavy machinery would be expected. Because of the projected low amounts of human activity on the project site during the long-term operation of the facility, many wildlife species may return to the habitat surrounding the Project Area following construction (Gabrielsen and Smith 1995; Knight and Cole 1995a; Knight and Cole 1995b).

Ground disturbance during construction, including vegetation removal and vehicles and heavy machinery entering and exiting the Project Area during the construction phase, would lead to an increased risk of weed invasion in the habitat surrounding the Project Area. Weed invasions degrade wildlife habitat in several ways. Weeds outcompete most native plants, and weed invasions often lead to a homogenous vegetative landscape. Weedy habitats often contain fewer highly nutritious forage species for grazers and herbivores. A heavy weed invasion would either displace wildlife from this habitat or lead to reduced health for individuals. Furthermore, some weed species, such as red brome, are fire dependent and create an environment that is prone to frequent wildfires. Under certain and natural conditions, wildfires can be beneficial to wildlife, but they are harmful to wildlife when they promote further weed invasion or result in direct mortality of wildlife. Furthermore, the Sonoran Desert ecosystem takes up to 30 years to recover from fire (Alford et al. 2005); therefore, the introduction of species such as red brome would create an unnatural fire regime. The Proposed Action includes a 198,182.4 linear-foot project perimeter, which would be where the potential for a noxious weed invasion is highest. Section 4.16.4 (Impacts to Invasive and Noxious Plant Species) describes this concept in detail.

Road construction, improvements, and use can result in direct impacts to wildlife individuals (such as collisions between wildlife and vehicles), resulting in wildlife mortality. High levels of mortality in a population can lead to an overall reduction in the regional population size and health. The potential for wildlife to be struck and killed by vehicles decreases with decreased rates of traffic. It is expected that during construction, approximately 1,000 vehicle trips would be taken on the proposed access roads both during peak morning hours and again at peak evening hours (Table 2.15, Comparison of Alternatives) After construction is over, vehicle trips would be reduced to approximately 46 trips during peak morning hours and again during peak evening hours. These numbers suggest that although the risk of wildlife mortality due to vehicle collisions would rise throughout the long term, risks in the short term (during the 39 months of construction) would be much higher than the long-term risk. Furthermore, because peak traffic hours are anticipated to occur in the morning and again in the evening, crepuscular species (species that are most active during the morning and evening hours), such as mule deer, mountain lion, and coyote, have a higher risk of being affected by road traffic.

Roads can also effectively act as a movement barrier to some wildlife species, especially when the road is wide, paved, and handles high amounts of traffic, as would occur on the western access road during the construction period. Species that are most susceptible to barrier effects are those that tend to avoid roads and also require large tracts of habitat for survival (Forman et al. 2003), such as the bighorn sheep, bobcat, mountain lion, and Sonoran desert tortoise. Other wildlife groups vulnerable to these effects include small mammal and amphibian species. Because of the presence of roads and barrier effects (which reduce landscape connectivity), these species are more susceptible to reduced gene flow and a reduced regional population size. Many wildlife species are therefore at a greater risk of a reduction in the regional population size due to the presence of roads. Wildlife movement in the analysis area is further discussed in Section 4.19.4 (Wildlife Linkages).

After project construction is complete, operational and maintenance activities would alter the surrounding environment in a variety of ways that would impact wildlife behavior and increase the risk of health effects on wildlife. Some of these impacts would result from light and noise pollution, ground vibration, steam venting, windborne fugitive dust, the potential for on-site residual pollutants to be mobilized during stormwater discharge events, and the control of noxious and invasive plants through the use of herbicides. Although Section 4.9.3.2 (Operations) states that ground vibrations would not be felt from the nearest noise receptors, these receptors are based on human perception, and are located 0.9 mile away from the rotating machinery that would produce these vibrations. Wildlife would be able to walk up to the project fence line, and may be able to feel ground vibrations from the rotating machinery from that proximity. Operational and maintenance activities would result in noise and light pollution, infrequent steam venting, and fugitive dust, which would increase stress levels of individuals in proximity and alter normal patterns of behavior away from these activities, as described in Section 4.19.1 (Analysis Areas and Analysis Assumptions). In addition, the presence of leaked HTF and herbicides would increase the risk of health consequences to individuals and local populations.

During the maintenance and operation of the facility, wildlife would be displaced from an area beyond the project footprint due to human noise and activity and operations activities described above. Because there is no research to support to what extent displacement beyond the project footprint would occur relative to large-scale solar development, the exact effects are unknown (see Section 4.19.1 [Analysis Area and Analysis Assumptions] for a discussion on the effects of human noise and activity on wildlife). However, wildlife avoidance of anthropogenic disturbances has been studied for other types of development such as road construction and urban development. An avoidance area surrounding roads, termed a "road-effect zone" (Forman and Deblinger 2003) has been documented for snakes (Rudolph et al. 1999, Shine et al. 2004, Andrews and Gibbons 2005), desert tortoises (von Seckendorff Hoff and Marlow 2002, Boarman and Sazaki 2006), birds (van der Zande et al. 1980, Reijnen et al. 1995, Pocock and Lawrence 2006), bobcats (Lovallo and Anderson 1996), desert bighorn sheep (McKinney and Smith 2007), and mule deer (Rost and Baily 1979). Similarly, a "disturbance zone" in which animals avoid seemingly suitable habitat adjacent to urban development (Theobald et al. 1997) has been documented for lizards (Germaine and Wakeling 2001), deer (Vogel 1989), and other species. These studies indicate that the influence of anthropogenic features such as roads and urban development extend beyond the physical footprint of the structures themselves, degrading adjacent habitat and altering species composition and behavior. These effects would continue for the life of the project.

Ninety acres of evaporation pond surface would be constructed under the Proposed Action, consisting of three 10-acre ponds for the 125-MW unit and three 20-acre ponds for the 250-MW unit (Section 2.5.4.2.1, Wastewater). Based on experience at other solar facilities, it is expected that these ponds would accumulate substances that are nonhazardous at low concentrations. These substances could include chloride, sodium, sulfate, total dissolved solids, biphenyl, diphenyl oxide, potassium, selenium, and phosphate. Evaporation ponds would be located within the fenced portion of the solar field footprint, and they would not be accessible by most wildlife groups. However, they would be accessible by some birds

and bats, which would be able to fly into the project footprint. Given the proximity of the Project Area to the Gila River, the evaporation ponds will likely attract migratory and resident waterfowl, shorebirds, and passerines. The evaporation ponds would be designed with sloping sides intended to discourage wading birds from accessing the ponds (Table 2.2 Applicant-committed Environmental Protection Measures). Small mammals, reptiles, and amphibians would also be able to pass through the perimeter fencing into the project footprint and gain access to the evaporation ponds. Due to the scarcity of available water in the Sonoran Desert ecosystem, and the high use of wildlife of small manmade waters throughout the region, it is likely that wildlife will try to use these ponds regardless of the size.

The effects of selenium ingestion on aquatic birds have been studied intensely. Selenium is known to bioaccumulate, meaning that it can be ingested by animals through food and water and accumulates in the body. It is concentrated into species that rank high on the food chain, such as insectivorous and predatory birds and bats and can become toxic (Brix et al. 2000). Effects of selenium ingestion on birds often show up as egg and chick defects (Eisler 1985). Exact effects of selenium ingestion on bats are unknown, but because they are long lived, there is a high potential for dangerous levels of bioaccumulation of potentially toxic substances, such as selenium (O'Shea et al. 2000). The proposed evaporation ponds would also have the potential to collect high levels of sodium, creating a hypersaline environment for exposed wildlife. Effects of hypersalinity on birds have been studied in evaporation ponds associated with oil fields. Some effects include a condition called salt toxicosis and feather encrustation (Gordus 2002; USFWS 2009). These conditions can result in internal organ failure, neurological damage, hypothermia, or drowning.

Effects on wildlife from many other substances that would accumulate in the evaporation ponds are largely unknown; however, high exposure levels of many of these other substances have been shown to be harmful to human health (Ouw et al. 1976, Mazaffarian and Rimm 2006). Exposure to high levels of selenium, sodium, and other potentially toxic constituents would have long-term adverse effects on birds, bats, small mammals, amphibians, and reptiles in the analysis area.

The presence of a gen-tie power line, as described under the Proposed Action, would increase the potential for raptor and other migratory bird species to be killed from power line collisions and electrocution. Power poles are attractive sites for raptors and migratory birds to perch, roost, loaf, and nest (Avian Power Line Interaction Committee [APLIC] 2006). This behavior brings birds into the proximity of live power lines and can often lead to collisions with wires and electrocution. The exact effects that power line mortalities have on avian populations are unclear, especially because power line construction often occurs concomitant with other types of development. However, all migratory birds and raptors are protected under the MBTA, and the "taking" of any individual is a violation of that act.

Factors that influence avian risk of collision with power lines can be divided into three categories: 1) those related to avian species (i.e., habitat use, body type, age), 2) those related to the environment (i.e., weather, line visibility, human activities that may flush birds into lines), and 3) those related to the configuration and location of lines (i.e., inadequate separation between energized conductors, proximity of line to important bird habitat and topographical features) (APLIC 2006). In the Project Area, the risk of avian mortality due to these factors would be identical among all alternatives because these three factors would be the same across all alternatives. All of these factors being equal, the probability of a bird encountering the power line increases with power line length. Under the Proposed Action, approximately 3 miles of transmission line would be built.

Under the Proposed Action the CCC stock pond located in the eastern portion of the Project Area would be removed. This action would affect big game and other wildlife species that regularly use this pond as a source of drinking water by forcing them to travel longer distances for water. In addition, this pond may serve as breeding habitat for amphibian species. Species breeding in the pond would be forced to travel to

different breeding sites. However, several more stock ponds are present in the analysis area, and they would continue to provide aquatic habitat for wildlife. Amphibian eggs, tadpoles, and other aquatic wildlife would be killed during pond removal.

As described in Section 2.5.2.7 (Off-site Drainage Collection and Discharge Facilities), collection channels would be constructed outside of the perimeter fence at the southern perimeter of the main project footprint to collect the upstream stormwater drainage. The design of these collection channels would allow wildlife to move across the channel and not become entrapped inside because of the following design features: channel sides would have gentle slopes (6 feet horizontally to 1 foot vertically); channel walls would not be greater than 6 feet, except in short sections where the outside bank of a curve would reach up to 8 feet (super-elevated); and the channel substrate would be either earthen or riprap. The presence of these collection channels would not create an entrapment hazard for wildlife, nor would they impact wildlife movement patterns.

As described in Sections 4.18.1.3.1 (Impacts to Surface Water Resources during Construction) and 4.18.1.3.5 (Impacts to Surface Water Resources during Operations), surface water flows in washes, uplands, and floodplains would be returned to pre-construction conditions and would likely match that of the surrounding landscape. Because of this, there would be no broad-scale mortality of vegetation due to disruptions in surface water flows, and there would therefore be no impact on wildlife distribution and abundance beyond the SSEP footprint.

4.19.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Effects on general wildlife species from Alternative A would be identical to those described for the Proposed Action, except for the following details.

As displayed in Table 4.113, Alternative A would disturb 9.6 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community. This represents a <1% change in total disturbance when compared to the Proposed Action. It would also disturb 61.7 fewer linear feet (<1%) of wildlife habitat in the Xeroriparian Wash vegetation community. The reduction in disturbed acres and linear feet would occur because water demands under Alternative A would require two groundwater wells, compared to four wells under the Proposed Action. Although there would be a slight reduction in disturbed habitat under Alternative A, it would not represent a considerable overall reduction, and the difference in effects between alternatives would be negligible.

Alternative A would create a project perimeter of 184,905.7 linear-feet. This perimeter would be 13,276.7 linear-feet (7%) smaller than the Proposed Action, reflecting the project perimeter associated with two fewer water wells and the associated access road. This smaller perimeter would reduce the area of increased potential for weed invasion. The impacts on wildlife described above regarding noxious weed invasions would still occur under this alternative, but would occur at a lower intensity than the Proposed Action.

4.19.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Sub-alternative A1 would have a smaller footprint and therefore displace fewer wildlife individuals than under the Proposed Action. As displayed in Table 4.113, Sub-alternative A1 would disturb 1,607.4 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community. This represents a 44% decrease in total disturbance when compared to the Proposed Action. It would also disturb 16,078.9 fewer linear feet (41% less) of wildlife habitat in the Xeroriparian Wash vegetation community. Furthermore, all impacts related to the removal of the CCC stock tank would be avoided under this alternative. An approximately 1-acre evaporation pond would be constructed under this Sub-alternative (Sections 2.7.2.3 and 2.7.4.2.1), which is 89 fewer acres than under the Proposed Action. The impacts to wildlife from evaporation

pond water ingestion, as described under the Proposed Action, would still occur to animals able to access the pond; however, the probability that these effects would impact wildlife populations is decreased when compared to the Proposed Action. The nature and magnitude of impacts resulting from the proposed roads would remain the same.

Under Sub-alternative A1, the gen-tie power line would run approximately 3.2 miles, which represents a 6.7% increase in power line length when compared to the Proposed Action. Under this sub-alternative, the nature of impacts of power lines on avian species, as described under the Proposed Action, would remain the same, but the magnitude would be slightly increased.

This alternative would leave intact a riparian wash that runs along the east side of the Project Area, which functions as a wildlife movement corridor. By leaving this corridor intact, this alternative would avoid the impacts to wildlife movement in that riparian wash, as discussed under the Proposed Action.

Sub-alternative A1 would create a project perimeter of 171,308 linear feet. This perimeter would be 26,874.4 linear feet (13.6%) smaller than the Proposed Action. This smaller perimeter would reduce the area of increased potential for weed invasion compared to the Proposed Action. The impacts on wildlife described above regarding noxious weed invasions would still occur under this alternative, but would occur at a lower intensity than the Proposed Action.

Under Sub-alternative A1, a maximum of 282 daily peak hour vehicle trips during construction and 16 daily peak hour vehicle trips during operations would be anticipated. This is 64.5% and 65.2% fewer vehicle trips (respectively) than projected under both the Proposed Action and Alternative A. The nature of habitat fragmentation and road barrier impacts to wildlife is described in Section 4.19.2.2.

4.19.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

Alternative B was developed in part due to concerns regarding impacts to wildlife linkages and travel corridors. Under this alternative, a smaller generating facility would be built, and therefore a smaller project footprint would be necessary. Water demands would dictate that three water wells would be drilled, as compared to four under the Proposed Action. Because of the reduced footprint, fewer wildlife individuals would be displaced, as described under the Proposed Action, both during project construction and throughout the life of the project. As displayed in Table 4.113, Alternative B would disturb 1,226.1 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community than the Proposed Action. This represents a 34% change in total disturbance. It would also disturb 16,417.6 fewer linear feet (43%) of wildlife habitat in the Xeroriparian Wash vegetation community. This alternative would leave intact a large riparian wash that runs along the east side of the Project Area, which functions as a wildlife movement corridor. By leaving this corridor intact, this alternative would avoid some of the impacts to wildlife movement discussed under the Proposed Action.

Under Alternative B, a maximum of 950 vehicle trips at morning peak hours and 950 trips at evening peak hours during construction would be anticipated. This is 5% fewer vehicle trips than projected under both the Proposed Action and Alternative A. It is unlikely that a 5% reduction in vehicle trips would result in measurably reduced road barrier impacts to wildlife (described in Section 4.19.2.2).Alternative B would create a project perimeter of 178,399.6 linear-feet. This perimeter would be 19,782.8 linear-feet (10%) smaller than the Proposed Action, reducing the area of high potential for weed invasion. Impacts from noxious weed invasion (described under the Proposed Action) would still occur under this alternative, but would occur at a lower intensity than under both the Proposed Action and Alternative A, because fewer linear feet of surface disturbance would be susceptible to weed invasion.

The CCC stock pond east of the Project Area would remain intact under Alternative B, leaving this water source intact for wildlife use. This alternative would avoid displacement impacts on wildlife using this pond. For these reasons, Alternative B would have fewer long-term adverse effects on wildlife than would the Proposed Action.

4.19.2.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on general wildlife with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed with the potential to affect wildlife would not change under this option.

4.19.2.7 GENERATION TIE LINE OPTION

Impacts to wildlife habitat as a result of the Gen-tie Line Option would be the same as those described under vegetation and special-status species in Section 4.16.2.7 and 4.16.3.7.

The Gen-tie Line Option would not change noise levels because it would not generate any new or additional sound. Traffic would also not change by the selection of this option, because no additional vehicles would be required for its implementation.

Under the Gen-tie Line Option, the gen-tie power line would run approximately 3.6 miles when combined with Sub-alternative A1 and 3.4 miles when combined with all other action alternatives. This represents a 20% and 13.3% increase in power line length (respectively) when compared to the Proposed Action. Under this option, the nature of impacts of power lines on avian species, as described under the Proposed Action, would remain the same, but the magnitude would be slightly increased.

4.19.3 Special-status Species

The following section describes impacts to special-status species under the No Action alternative, Proposed Action, and each of the alternatives. Special-status species are listed and defined in Section 3.19.5.2 (Wildlife, Special-status Species). Use of the vegetation types within the Project Area by special-status species is summarized below.

Special-status wildlife species with the potential to use the Sonoran Creosotebush-Bursage Scrub vegetation community for breeding consist of avian species such as the Western burrowing owl, Costa's hummingbird, and Gila woodpecker. All special-status bird species identified for this project use this vegetation community for foraging and cover. All special-status bat species identified for this project would use this vegetation community for foraging. The Sonoran desert tortoise would use this habitat for movement between more suitable habitat patches.

Use of the Xeroriparian Wash vegetation community by special-status species is similar to that described for the Sonoran Creosotebush-Bursage Scrub community except that the suite of breeding birds would shift. Special-status birds with the potential to breed in Xeroriparian Wash habitat also include crissal thrasher and Lucy's warbler.

4.19.3.1 NO ACTION ALTERNATIVE

Under the No Action alternative, wildlife habitat would not be removed, and therefore no displacement effects on special-status species would occur. Impacts associated with the continuation of livestock grazing and dispersed recreation use would continue to affect fossorial special-status species (such as the Western burrowing owl) through habitat competition, as described in Section 4.19.2.1 (General Wildlife, No Action).

4.19.3.2 PROPOSED ACTION

In general, special-status species would also be affected by the impacts to general wildlife species identified under the Proposed Action (Section 4.19.2.2). Additional impacts on individual species are described in this section.

During field reconnaissance in 2009, Western burrowing owl individuals, burrows, and sign were found in the northern portion of the Project Area. Surveys were conducted again in May 2011 and found owl individuals, burrows, and sign throughout the Project Area. Details of the results of this survey can be found in Appendix I (Burrowing Owl Relocation Analysis). Individuals breeding and/or wintering in the Project Area would be displaced from habitat in the long term (at least 30 years) due to project construction and operations. These individuals may be forced into areas of less-suitable habitat. In addition, potential Western burrowing owl breeding habitat located in permanent disturbance areas would be removed, eliminating the potential for future breeding in that area. The long-term removal of vegetation would also reduce the amount of habitat available for burrowing owl prey species (large insects and small mammals), which may lead to reduced health in owl individuals.

In the short term, human noise and activity during construction would displace burrowing owls from an area surrounding the Project Area, as described in Section 4.19.1 (Analysis Area and Analysis Assumptions). The size of this temporary disturbance buffer would depend on the amount of human noise and activity in the Project Area, as described under Section 4.19.2.2 (General Wildlife, Proposed Action). This displacement buffer would increase during the owl breeding and nesting seasons, when individuals are more protective of their young (April–July) and therefore more sensitive to disturbance. The removal of vegetation for temporary uses would displace breeding owls in the short term, but depending on the success of reclamation efforts, may create breeding owl habitat in the long term by loosening otherwise compacted soils and allowing burrows to be created.

As per the action alternatives' applicant-committed environmental protection measures (see Table 2.2), the Project Area and a 200-m buffer would be surveyed for burrowing owls prior to construction. If any burrowing owl individuals are located during these surveys, they would be relocated to a suitable site within the analysis area and an artificial burrow site would be built for their use. The relocation site would be defined by the BLM and cooperating agencies. The relocation of burrowing owls is a standard practice and would ensure compliance with the MBTA. The relocation site would be selected in part because it resembles suitable habitat and has a low probability of outside disturbances (e.g., feral dogs, vehicular traffic, vandalism, further changes in vegetation structure).

Owl relocation would affect the owl individuals being moved by increasing stress levels during the relocation event. If the location to which the owls are moved is currently supporting a burrowing owl population, competition for food and other resources would be locally increased, resulting in decreased health for the population. If the location to which to owls are moved is not currently supporting a burrowing owl population, it may be somewhat less suitable than the Project Area location, resulting in decreased health for the relocated owls. The relocation of burrowing owls has occasionally proven to be unsuccessful, and had resulted in owl mortalities. However, it is generally seen as an effective and viable means of compliance, and qualified biologists would be responsible for the relocation.

Although there is no breeding habitat for golden eagles within a 10-mile radius of the Project Area, migratory and nonbreeding individuals may forage in the analysis area. A decline in the population of prey species such as jackrabbits, snakes, juvenile ungulates, and passerines due to displacement and other effects described in Section 4.19.2.2 (Proposed Action) would cause foraging golden eagles to seek out other more suitable foraging habitat. However, roadkill is often a source of food for golden eagles, and they may benefit from wildlife getting struck and killed by cars. Due to their large wing span, golden

eagles would have a higher potential than smaller raptors for mortality from electrocution on the gen-tie power line. This is because an eagle's large wing span can connect energized conductors (or an energized conductor with grounded hardware) on power poles, inducing electrocution. Because of the typical spacing of the conductors, smaller birds cannot touch two at the same time (APLIC and USFWS 2005).

Seven special-status bat species have the potential to forage in the Project Area and roost in the analysis area. As described above, bats would be able to access the proposed evaporation ponds, which could increase their risk of toxin-related health effects through exposure to potentially toxic levels of selenium and other constituents, as described in Section 4.19.2.2. All of the bat species that may be present in the Project Area are insectivorous, and if potentially toxic constituent levels in the ponds rise to a high level, bioaccumulation of selenium and other potentially toxic constituents in bats is likely (O'Shea et al. 2000).

Under the Proposed Action, the CCC stock pond that is located in the eastern portion of the Project Area would be removed. This action would reduce potential breeding areas for the Great Plains toad, forcing individuals to travel to other breeding areas. Toad eggs or tadpoles that may be in the water prior to pond removal would be unable to move, and would be killed. Although the exact effect of the removal of this pond is unknown, several more stock ponds are present in the analysis area, and they would continue to provide breeding habitat for this species. Toads and other amphibians are also susceptible to road barrier effects and high levels of mortality due to vehicle strikes, as described in Section 4.19.2 above (General Wildlife).

Although there is no BLM-designated habitat in the Project Area for the Sonoran desert tortoise, habitat exists for this species in the analysis area within 1.2 miles both north and south of the Project Area (see Map 29). It is unlikely that the tortoise uses the Project Area habitat for breeding and foraging; however, this species would likely use this habitat for dispersal between suitable habitat patches. Tortoise dispersal across valleys between desert mountain ranges is estimated to occur approximately once per generation (Edwards 2003), and these events seem to be very important for the long-term maintenance of populations (Edwards 2004). Therefore, some amount of tortoise dispersal would be impeded in the long term due to the presence of the SSEP and associated roads.

Predation on juvenile desert tortoises by ravens has been documented in parts of the Mojave Desert (Boarman 2003). Ravens may be attracted to the Project Area by human refuse and ponded water, thereby increasing the chances of predation on juvenile desert tortoises. This attraction may impact the dispersal of desert tortoises en route through the analysis area. However, applicant-committed environmental protection measures state that "Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Approved enclosed refuse containers would be used throughout the SSEP. Refuse and trash would be removed from the sites and disposed of in an approved manner" (Table 2.2 Applicant-committed Environmental Protection Measures). This measure would minimize raven attraction to the Project Area by making trash unavailable to wildlife. Ponded water, including the proposed evaporation ponds, could still attract ravens to the Project Area.

4.19.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Impacts to special-status species under Alternative A would be identical to those described for the Proposed Action. Impacts resulting from total disturbance acres, as described under Section 4.19.2.3 (General Wildlife, Alternative A), would also occur.

4.19.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Impacts to special-status wildlife species under this alternative would be similar to those described for Alternative B in terms of impacts on burrowing owls, golden eagle foraging habitat, and the CCC stock pond, because direct disturbance comparable to Alternative B would occur under Sub-alternative A1.

4.19.3.5 ALTERNATIVE B: REDUCE FOOTPRINT

During site reconnaissance, all owl and burrow sightings were located in a tight cluster at the northeastern corner of the solar field, a portion of which is avoided under Alternative B (Pape 2009; see Map 29). Two burrow locations and one owl sighting were located outside of Alternative B's Project Area, and one burrow location and owl sighting were located in Alternative B's Project Area. Because of the two burrowing owl burrow locations outside of the Project Area, Alternative B would likely avoid the direct disturbance of an unknown amount of suitable burrowing owl breeding habitat (see Map 29). However, because these burrow locations are adjacent to the Project Area, it is likely that some habitat degradation, including human noise and activity during construction (as described in Section 4.19.1, Analysis Area and Analysis Assumptions), and some degree of noxious weed invasion (as described in Section 4.19.2.2, Proposed Action), would still occur.

Direct disturbance to the one known burrow located inside the Project Area would also occur. However, because this alternative would disturb fewer acres of habitat than the Proposed Action, it is possible that fewer burrowing owls would need to be relocated. This would result in the avoidance of the relocation effects, as described under the Proposed Action, for an unknown number of burrowing owls.

Under this alternative, golden eagle prey populations would be impacted to a lesser degree (thereby reducing impacts to foraging golden eagle populations) than under the Proposed Actions due to less direct disturbance. This is because the main project footprint would occupy approximately 1,800 acres, or 51% of the footprint under the Proposed Action.

Because the CCC stock pond would remain intact under this alternative, this source of potential breeding habitat would remain available for the Great Plains toad. Existing eggs and tadpoles would not be killed. Alternative B would avoid impacts to breeding habitat for this species.

4.19.3.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on special-status species with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed with the potential to affect wildlife would not change under this option.

4.19.3.7 GENERATION TIE LINE OPTION

Impacts to special-status species with the addition of the Gen-tie Line Option would be the same as those described under each alternative.

4.19.4 Wildlife Linkages

Wildlife linkage models are described in Section 3.19.6 (Wildlife Linkages). Table 4.115 displays the acres of wildlife habitat (by vegetation community type) that would be removed in the Gila Bend-Sonoran Desert National Monument and Buckeye Hills-Sonoran Desert National Monument linkages. The acreage of wildlife habitat removal within each linkage would be the same under all action alternatives. The total amount of acres of wildlife habitat that would be removed or disturbed under all action alternatives is identical to the acres expressed for the Buckeye Hills-Sonoran Desert National Monument Linkage. This is because the portion of the Gila Bend-Sonoran Desert National Monument linkage that would be affected by the project is completely contained within the Buckeye Hills-Sonoran Desert National Monument linkage (see Map 29).

The removal and disturbance of wildlife habitat would impact wildlife individuals and populations both in the long term and in the short term. Wildlife habitat removal for permanent use (new and improved roads,

water well sites, and the gen-tie power line) would occur due to project construction, operations, and maintenance within the solar field footprint. Permanent disturbances would eliminate wildlife habitat from use in the long term by replacing native vegetation with an industrial landscape unsuitable for wildlife. The removal of wildlife habitat for temporary uses would occur at access road locations for the gen-tie power line, buried gas pipelines, and temporary access road improvements. Temporary vegetation removal would be reclaimed, but affects may persist into the long term (greater than five years). Successful reclamation would return wildlife habitat to as close to pre-construction conditions as possible, and because of the slow vegetative growth of the Sonoran desert, may take from five to ten years (see Table 2.2 Applicant-committed Environmental Protection Measures and Section 4.16.1). These areas would be used by certain wildlife species after reclamation.

Table 4.115 Disturbance to Wildlife Habitat by Linkage Corridor under All Alternatives for Wildlife Linkages

Type of Disturbance	No Action	All Action Alternatives except Sub-alternative A1* Wildlife Habitat in the Sonoran Creosotebush-Bursage Scrub Vegetation Community (Acres)	All Action Alternatives except Sub-alternative A1** Wildlife Habitat in the Xeroriparian Wash Vegetation Community (Linear feet)	Sub-alternative A1: Photovoltaic Wildlife Habitat in the Sonoran Creosotebush-Bursage Scrub Vegetation Community (Acres)	Sub-alternative A1: Photovoltaic Wildlife Habitat in the Xeroriparian Wash Vegetation Community (Linear feet)
Gila Bend-Sonoran Desert National Monument Linkage					
Permanent use	0	7.7	53.2	n/a	n/a
Temporary use	0	1.2	0	n/a	n/a
Total Disturbance	**0**	**8.9**	**53.2**	**n/a**	**n/a**
Buckeye Hills-Sonoran Desert National Monument Linkage (SSEP Total)* **					
Permanent use	0	1,143.5	12,624.6	1,115.9	12,426.2
Temporary use	0	5.1	0	5.1	0.0
Total Disturbance	**0**	**1,148.6**	**12,624.6**	**1,121.0**	**12,426.2**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for all action alternatives with brine concentrator option and Alternative B with the brine concentrator option, except Sub-alternative A1.

**Linear feet of disturbance would be the same for all action alternatives with brine concentrator option and Alternative B with the brine concentrator option, except Sub-alternative A1.

*** The acres expressed for this linkage also represent total acres of disturbance for the SSEP. This is because the portion of the Gila Bend-Sonoran Desert National Monument linkage that would be affected by the SSEP is completely contained within the Buckeye Hills-Sonoran Desert National Monument linkage.

4.19.4.1 NO ACTION ALTERNATIVE

Activities described under the No Action alternative would not impact wildlife linkages. This alternative would not disrupt normal wildlife movement patterns because no wildlife habitat would be removed or otherwise disturbed.

4.19.4.2 PROPOSED ACTION

4.19.4.2.1 Gila Bend-Sonoran Desert National Monument Linkage

Under the Proposed Action, 8.9 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community in the Gila Bend-Sonoran Desert National Monument linkage would be removed; 1.2 acres of this would be for temporary uses (pending rehabilitation) (see Table 4.115). In addition, 53.2 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community would be removed. The Proposed Action would bisect the northernmost arm of this linkage with a new road and the gen-tie power line, affecting 100% of the width of the linkage (see Map 29). The road and vegetation clearing necessary for power line construction and maintenance would form a barrier to the movement of the focal species used to develop this model (see Chapter 3 for focal species descriptions). Vehicle travel along the access road would result in an increased risk of wildlife strikes and road mortality. This is described in more detail in Section 4.19.4.2.2 below. Most impacts would occur in the short term due to the higher projected traffic levels during construction, and would decrease once construction finished.

Although the boundary of this linkage was devised to connect the Sonoran Desert National Monument ultimately with the Gila Bend Mountains, it also provides connectivity from the monument (by way of the Buckeye Hills) to the Gila River corridor. Riparian systems are one of the rarest habitat types in North America, and they are very important for the persistence of wildlife in arid environments, such as the Southwest. The Gila River and its associated riparian vegetation provide habitat for many species. Bisecting this linkage with a road and gen-tie power line (affecting 100% of the width of the linkage and acres of habitat displayed in Table 4.115) would create obstacles to wildlife movement from Sonoran Desert National Monument into the Buckeye Hills and finally to the Gila River. This would mostly affect highly mobile species, such as the bighorn sheep, mule deer, mountain lion, bobcat, and desert tortoise. However, the Sonoran Desert National Monument linkage has four arms that cross from the Gila Bend Mountains over the Gila River and to the monument (Beier et al. 2008). The arm that would be bisected by the Proposed Action is the most circuitous route from the Sonoran Desert National Monument to the Gila River. The impacted linkage arm is considered the "biologically best corridor" by AGFD only for the desert tortoise, which is a species that would not be traveling long distances in search of water. For these reasons, the Proposed Action would impact wildlife species accessing the Gila River from the monument by way of the Buckeye Hills.

Effects of the Proposed Action on the Sonoran desert tortoise are discussed under Section 4.19.3.2 (Special-status Species, Proposed Action).

4.19.4.2.2 Buckeye Hills-Sonoran Desert National Monument Linkage

Under all action alternatives, 1,148.6 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community within the Buckeye Hills-Sonoran Desert National Monument linkage would be disturbed; 5.1 acres of this would be for temporary use (pending rehabilitation) (see Table 4.115). In addition, 12,624.6 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community would be disturbed. This disturbance includes the construction of portions of new road, upgrading existing roads, construction of the gen-tie power line, and construction of (a portion of) the solar field footprint (see Map 29). Solar field construction would impact the eastern portion of the linkage by removing a large area of

existing wildlife habitat and replacing it with a fenced (industrial) solar field incompatible with wildlife use. Displacement effects are described in the General Wildlife section above (Section 4.19.2.2). Excluding the roads and power line, the solar field at its widest point would occupy approximately 38% of the width of the linkage, effectively narrowing the width of the travel corridor. The roads and power line would cut across the remaining width of the linkage, from SR-85 to the solar field (see Map 29). The combined area of the solar field, roads, and power line would affect 100% of the width of the linkage.

Highly mobile species, such as bighorn sheep, mule deer, mountain lion, and Sonoran desert tortoise, can move long distances to access suitable breeding or foraging sites. They rely on linkages to connect large blocks of suitable habitat. For highly mobile species, the Proposed Action would create a barrier to wildlife movement patterns. These effects are described in more detail in Section 4.19.2.2 (General Wildlife, Proposed Action). The solar field would be fenced and impermeable to wildlife movement (Section 4.19.5, Mitigation Measures). Wildlife movement in this area would be funneled around the solar field for the long term, and across the access roads to the west and south of the Project Area. The proposed access road and gen-tie power line that connect the solar field with SR-85 would also impede wildlife movement through this linkage. Because peak traffic hours are projected to occur in the morning and evening, crepuscular wildlife species would be at a higher risk of being affected by the road barriers. Highly mobile crepuscular species (species with high levels of activity during morning and evening hours) modeled for this linkage consist of the mule deer and mountain lion. Traffic volume on this road during the construction period is projected at 1,000 trips at morning and evening peak times. During operation of the facility, peak traffic volumes are projected at 46 trips at peak times. Because of this, road barrier effects on wildlife would be more severe in the short term, during construction, and would occur at a relatively lower intensity in the long term (during operation).

Dispersal and genetic mixing between isolated populations of bighorn sheep contribute to the viability of the larger metapopulation. Because of this, the location of the Proposed Action inside wildlife linkages could make it more difficult and hazardous for individuals to travel between populations, and thereby limit genetic mixing and viability. Limiting genetic mixing would contribute to the further isolation of local populations and potentially contribute to the decline of the metapopulations as a whole (personal communication, Dana Warnecke 2011). It could also contribute to local extinctions of isolated populations. Excluding the roads and power line, the solar field at its widest point would occupy approximately 38% of the width of the linkage, effectively narrowing the width of the travel corridor. The roads and power line would cut across the remaining width of the linkage, from SR-85 to the solar field (see Map 29). The combined area of the solar field, roads, and power line would affect 100% of the width of the linkage.

Less mobile species, such as the badger, kit fox, javelina, Gila monster, Sonoran desert toad, and Tucson shovelnose snake, rely on linkage habitat for long-term genetic flow and for connectivity among populations. Linkages are also important for less mobile species to allow populations to shift their range in response to climate change, and to allow for recolonization after fire or epidemics (Beier et al. 2008a). For less mobile species, impacts to the Buckeye-Hills-Sonoran Desert National Monument linkage from the SSEP center on displacement due to the destruction and degradation of habitat as well as the effects of road barriers described for highly mobile species. The Proposed Action includes the permanent removal of 1,143.5 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub community, the removal of vegetation for temporary purposes (pending rehabilitation) of 5.1 acres this habitat, and the permanent removal of 12,624.6 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community within the linkage corridor.

Mule deer and javelina are examples of wildlife species that use Xeroriparian Wash vegetation community as travel corridors. These species would also be more susceptible to road barrier effects where roads intersect xeroriparian corridors. Movement patterns of these species would be especially altered and

possibly impeded by the 12,624.6 linear feet of this type of habitat that would be removed under the Proposed Action.

4.19.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Impacts on wildlife linkages under Alternative A would be identical to those described under the Proposed Action. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change under this alternative.

4.19.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

The nature of impacts to wildlife linkages under Sub-alternative A1 would be the same as those described under the Proposed Action, but the intensity of impacts would be slightly reduced. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would comprise 27.6 fewer acres (2.4%) of Sonoran Creosotebush-Bursage Scrub vegetation community. The nature and intensity of impacts in the Xeroriparian Wash vegetation community would be identical to those described for the Proposed Action. However, during construction hours under Sub-alternative A1, a maximum of 282 daily peak hour vehicle trips during construction and 16 daily peak hour vehicle trips during operations would be anticipated. This is 64.5% and 65.2% fewer vehicle trips (respectively) than projected under the Proposed Action, which would result in reduced road barrier impacts to wildlife as described in Section 4.19.2.2 (Proposed Action).

4.19.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

Impacts on wildlife linkages under Alternative B would be identical to those described under the Proposed Action. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change except for the following detail. Under this alternative and during construction hours, a maximum of 950 vehicle trips at morning and evening peak hours is projected. This is 5% fewer vehicle trips than projected under both the Proposed Action and Alternative A. It is unknown whether a 5% reduction in vehicle trips would result in reduced road barrier impacts to wildlife (described in Section 4.19.2.2 [Proposed Action]).

4.19.4.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on wildlife linkages with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change under this option.

4.19.4.7 GENERATION TIE LINE OPTION

Impacts to wildlife linkages with the addition of the Gen-tie Line Option would consist of disturbance to the Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash vegetation communities within the Buckeye Hills-Sonoran Desert National Monument and the Gila Bend-Sonoran Desert National Monument linkages.

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, additional impacts, when compared to the proposed gen-tie line alignment, would consist of 5.1 acres of temporary and 3.6 acres of long-term disturbance to Sonoran Creosotebush-Bursage Scrub vegetation in the Buckeye Hills-Sonoran Desert National Monument linkage (Table 4.116). If the Gen-tie Line Option were added to Sub-alternative A1, additional impacts would consist of 6.8 acres of temporary and 5.0 acres of long-term impact to Sonoran Creosotebush-Bursage Scrub in the Buckeye Hills-Sonoran Desert National Monument linkage. For Sonoran Creosotebush-Bursage Scrub vegetation in the Gila Bend-Sonoran Desert National

Monument linkage, an additional 0.2 acre of temporary and 0.2 acre of long-term disturbance would occur if the Gen-tie Line Option were added to any of the action alternatives. In all cases, the implementation of the Gen-tie Line Option in combination with any action alternative would result in less than a 1% increase and less than a 5% increase in surface disturbance in the Buckeye Hills-Sonoran Desert National Monument linkage and Gila Bend-Sonoran Desert National Monument linkage, respectively.

Table 4.116 Additional Acres Disturbed with the Gen-tie Line Option

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Buckeye Hills-Sonoran Desert National Monument linkage		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.6	5.0
Total disturbance	**8.7**	**11.8**
Gila Bend-Sonoran Desert National Monument linkage		
Temporary disturbance	0.2	0.2
Long-term disturbance	0.2	0.2
Total disturbance	**0.3**	**0.3**

Note: Acres of disturbance do not include existing road surfaces.

If the Gen-tie Line Option were added to any of the action alternatives, additional impacts when compared to the proposed gen-tie line alignment would consist of 65 linear feet of disturbance to Xeroriparian Wash habitat in the Buckeye Hills-Sonoran Desert National Monument linkage (a 0.5% increase). There would be no additional impact to the Xeroriparian Wash in the Gila Bend-Sonoran Desert National Monument linkage from the Gen-tie Line Option.

Road barrier impacts to wildlife would not change with the selection of this option because no additional vehicles would be required for its implementation.

4.19.5 Potential Mitigation Measures

To reduce or eliminate the impacts of the Proposed Action and the action alternatives on wildlife and their habitat, the following potential mitigation measures are considered.

- To avoid the impacts of wildlife contacting hazardous and other human-made substances as well as to minimize the potential for vehicle collisions and exposure to human noise and activity, perimeter fencing of the SSEP would be designed to effectively exclude wildlife. Measures would include burying the fence at least 1 foot underground to keep animals from burrowing under it, and reinforcing the first 3 feet off the ground with small diameter mesh and/or silt fencing to keep small animals from entering.
- To minimize the potential for avian collisions with and electrocutions from power lines, the design and construction of all power lines would comply with the *Avian Protection Plan Guidelines* (APLIC and USFWS 2005) and the *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006).
- To prevent wildlife exposure to selenium or other potentially toxic constituents in evaporation pond water, wildlife would be excluded from accessing these ponds through a combination of fencing, netting, hazing, or other similarly effective measures.

- To protect migratory bird resources and comply with the MBTA, nest clearance surveys would be conducted by a qualified biologist prior to all vegetation clearing (and other surface-disturbing activities) taking place inside the bird nesting season (February 15–September 15) (Corman and Wise-Gervais 2005). All nests would either be protected in place until the chicks had fledged, or relocated into suitable habitat.
- To minimize the potential for wildlife mortality from vehicle collisions, caution signs indicating the potential for mule deer, bighorn sheep, and desert tortoise crossing would be posted periodically along each access route. Particular locations for these signs would be at the beginning and end of each access road and where roads intersect xeroriparian washes. Speed bumps would also be installed to further limit the speed of vehicles, as described in Section 4.15.9.1 (Installing Speed Bumps and No Parking Signage along New Access Road).
- To decrease the impacts of habitat fragmentation, access roads would remain unfenced perpendicular to the road alignment to the maximum extent possible while still ensuring public safety. This would allow for wildlife movement across roads.
- To minimize the impacts described above (Sections 4.19.2.2 and 4.19.3.2) of removing the CCC stock pond under the Proposed Action, the pond would be rebuilt in another nearby location outside of the Project Area but within the Buckeye Hills-Sonoran Desert National Monument linkage for wildlife use. The new location would be selected (and surveyed) to ensure that it would not result in significant conflicts with other resources.
- To minimize the risk of wildlife mortality from vehicle collisions, trash would be collected periodically from project access roads.

4.19.5.1 MITIGATION SPECIFIC TO THE SONORAN DESERT TORTOISE

- To minimize the potential for desert tortoise mortality, prior to ground-clearing construction activities, a desert tortoise monitor would survey the Project Area, followed by the enclosure of the solar fields with chain-link fencing. If tortoises are encountered they would be relocated outside of the Project Area.
- To minimize the potential for vehicle collisions with desert tortoises, vehicle speeds would not exceed 20 mph on all access roads. Speed limit signs would be installed. Caution signs indicating the potential presence of Sonoran desert tortoises would be posted at the beginning of any access road, and midway to the SSEP on each access road.
- Training would be provided to all construction personnel who would be present before and during the ground-clearing and fencing of the site. Training would include procedures on how to reduce tortoise mortality, such as checking stationary vehicles for tortoises, and recommendations on how to avoid disturbing tortoises that are detected.
- If any Sonoran desert tortoises are encountered during construction and operations, the contractor shall adhere to AZGFD *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects* (Revised October 23, 2007).
- To facilitate movement and dispersal across new and upgraded roads as well as to minimize the potential for vehicle collisions, under-road crossing structures for the Sonoran desert tortoise, in the form of culverts would be placed along the western access road, from SR-85 to the solar field. The most current data regarding culvert size, frequency, placement, and use of guidance fencing would be used at the time of construction. Additional educational signage denoting the potential for road kill would be placed in this zone.

4.19.6 Residual Impacts

Residual impacts would include the long-term removal of breeding, foraging, and cover habitat in all areas occupied by the SSEP. All of the action alternatives would include the removal of known and potential breeding habitat for the burrowing owl, foraging and cover habitat for many species of migratory birds, and portions of the Xeroriparian Wash vegetation community used as movement corridors by mule deer, mountain lions, and javelina. Species that currently inhabit the Project Area would be permanently displaced into adjacent habitat.

Although efforts would be made to educate drivers on the potential for wildlife to cross the proposed access roads, the risk of wildlife mortality due to collisions with vehicles could not be fully mitigated. The mitigation measures listed above would help to lower the potential for road kills.

Road-related mitigation measures would attempt to make roads and other linear features more permeable to wildlife movement. Signs educating drivers on the potential for wildlife crossings on the road surface would help to reduce road barrier effects on large-bodied species. Slow speed limits (20 mph) would further increase the permeability of access roads. Despite these mitigation measures, road-related barrier effects may still occur and result in reduced gene flow between some wildlife populations.

Although mitigation measures regarding noxious weeds (Section 4.16.5.1 [Potential Mitigation Measures for Vegetation Communities]) would help to reduce the level of noxious weed invasion into the Project Area, some level of weed introduction would likely occur.

Although completely excluding birds and bats from access to the proposed evaporation ponds is ultimately the goal of mitigation, this would be an iterative process, including trials and evaluations of several different protocols and techniques for exclusion. It is likely that some wildlife would gain access to the ponds during the course of choosing the most effective technique and implementation. Techniques such as hazing may initially be effective. Gas-operated exploders have proven relatively effective as an avian deterrent (Read 1999; Ronconi and St. Clair 2006). However, the effectiveness depends on a variety of factors, including the targeted species, numbers of birds present, availability of alternative sites for repelled birds, density of exploders, interval between explosions, and wind conditions (Marsh et al. 1991). It has been shown that individuals can become habituated to the explosions over time (Bomford and O'Brien 1990). Electronically produced distress calls and visual deterrents tend to be effective initially, but birds are often habituated to these deterrents, potentially rendering them ineffective over time (Belant et al. 1998; Esmoil and Anderson 1995; James et al. 1999; Marsh et al. 1991).

Excluding wildlife from access to potentially toxic constituents would help to reduce the long-term impacts (described in Sections 4.19.2.2 and 4.19.3.2) of constituent bioaccumulation in bird and bat species. Although health effects to some individuals may still occur due to the consumption of insects using the evaporation ponds, this measure would lessen the potential for effects on individuals and populations, and would prevent acute toxicity to individuals by preventing their use of the pond.

Exclusion of small-bodied wildlife (e.g., small mammals, amphibians, and reptiles) from the evaporation ponds would be attempted through the use of small-diameter mesh and/or silt fencing. However, these wildlife groups are able to penetrate very tight spaces, and may gain access to the ponds regardless of the attempted mitigation measures. Health effects and mortality of some small-bodied wildlife individuals may occur due to the inability to exclude them from the evaporation ponds.

Under the Proposed Action and Alternative A, the CCC stock pond would be filled in and removed, which would force wildlife to travel to another source of water, and would permanently displace breeding amphibians from this area. Replacement the stock pond in an alternate location would reduce the distance wildlife would need to travel and would provide a new water source and potential breeding location.

4.19.7 Short-term Uses versus Long-term Productivity

Impacts associated with construction activities would degrade the quality of wildlife habitat as described in Section 4.19.1 (Analysis Area and Analysis Assumptions) in the short term. Construction impacts include increased human noise and activity, increased vehicle traffic on access roads, and the removal of wildlife habitat for temporary use. After construction has finished, levels of human noise and activity and vehicle traffic would reduce, and temporary vegetation disturbances would be reclaimed. This project would reduce the amount of habitat available to wildlife species and displace wildlife individuals from habitat that has been removed or degraded. Because of road barriers and habitat disturbance to wildlife linkage corridors, this project would also affect wildlife movement patterns between adjacent mountainous habitats and reduce population gene flow and connectivity.

After the life of the project (approximately 30 years), all aboveground infrastructure would be removed, the ground would be recontoured, and the vegetation reclaimed to pre-project conditions. Once this was accomplished, wildlife would likely return to the area and use it as breeding, foraging, and cover habitat. With the decommissioning and rehabilitation of access roads, pre-project wildlife movement patterns, habitat connectivity, and gene flow might resume for some or all species that currently occur in the area.

4.19.8 Irreversible and Irretrievable Commitments of Resources

Irreversible impacts would consist of the increased risk of bioaccumulation of potentially toxic constituents in some bird, bat, small mammals, reptile, and amphibian individuals. Irretrievable commitments would consist of wildlife habitat removal and wildlife displacement for the project footprint and associated roads, pipelines, and power lines, which would be reclaimed after the life of the project.

4.20 Cumulative Impacts

4.20.1 Introduction

CEQ regulations for implementing NEPA define *cumulative impacts* as "… the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions (RFA) regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7).

BLM's NEPA Handbook states that the purpose of the cumulative effects analysis is to ensure the decision makers consider the full range of the consequences of the Proposed Action, alternatives to the Proposed Action, and No Action alternative (BLM 2008). Assessing the cumulative effects of the actions begins early in the NEPA process, during the identification of issues. During the scoping process for the SSEP EIS, the public and agency personnel identified several questions (issues) relating to cumulative effects for consideration and analysis in the EIS. The following is an excerpt from the *Sonoran Solar Energy Project Environmental Impact Statement Public and Agency Scoping Report* (BLM 2009d) that identifies the cumulative impact issues.

Cumulative Impact Issues

Issue 32: A number of other solar-generating power facilities are being considered in western Arizona, California, and Nevada and may impact a variety of resource values and uses, including water supply, endangered species, visual resource, and wildlife and threatened, endangered, and sensitive species habitat.

- What would be the cumulative effect of these facilities on the Sonoran Desert landscape?
- What past, present, and reasonably foreseeable projects and their connected actions (i.e., transmission needs associated projects) would be appropriate to include in a cumulative impacts analysis?
- What resources are appropriate to include in a cumulative impacts analysis? What are appropriate impact indicators and information to include in that analysis?
- How might climate change impact the cumulative effect on these facilities on the Sonoran Desert?

This issue and these questions form the foundation for the assessment of cumulative effects of the actions on the resource values and uses of the Project Area. Those resources that would be directly or indirectly affected by the Proposed Action, alternatives to the Proposed Action, and No Action alternative are analyzed below. If the actions under each alternative have no direct or indirect effect on a resource (as disclosed in Chapter 4, Environmental Consequences), then the cumulative impacts on that resource are not addressed below.

In framing the cumulative effects analysis, a geographic scope for the analysis must be established for each resource. Geographic scope is usually defined by the natural boundaries of the resources, rather than agency administrative boundaries, and it usually extends beyond the geographic scope of the Project Area. In this analysis, the cumulative effects analysis area (CEAA) is most often the Rainbow Valley, including the Waterman Wash watershed and the Rainbow Wash watershed. In some cases, the CEAA is much larger. For example, the CEAA for the assessment of cumulative effects on social and economic conditions includes Maricopa and Pinal counties. See Section 4.20.2 below for a description of each

resource CEAA and rationale for that selection. In addition to the geographic scope of the analysis, a timeframe for the analysis must also be established. For this cumulative effects analysis, the temporal scope is the projected life of the SSEP, which is 30 years.

In any NEPA analysis, it is preferable to quantify the assessment of effects (changes) on each affected resource. This is true for direct, indirect, and cumulative effects. Where possible, the following analysis is quantified. Where quantification is not available, a meaningful and qualified judgment of cumulative effects is included to inform the public and the decision maker.

An ID team was formed to analyze and disclose the direct, indirect, and cumulative effects of the Proposed Action, alternatives to the Proposed Action, and No Action alternative on the affected environment (resource values and uses of the Project Area). In the sections that follow, the ID team has identified and described the CEAAs by resource value and use, compiled a list of RFAs for use in the cumulative effects analysis (see Table 4.119), and analyzed and disclosed the effects of past, present, and RFAs, including the SSEP, on the affected elements of the environment.

4.20.2 Cumulative Effects Analysis Area(s)

The geographic scope for the cumulative impacts analysis is presented in six different CEAAs around the Project Area:

- Rainbow Wash CEAA
- Pinal and Maricopa Counties CEAA
- Grazing (the Beloat and the Arnold grazing allotments) CEAA
- Waterman Watershed CEAA
- Noise CEAA (5 km)
- Air Quality Nonattainment Areas

Six different CEAAs are necessary to capture the proper spatial scope of cumulative impacts for each resource. These areas were selected because they are large enough to include all potentially significant effects on the resources of concern and effects from the combined impacts of the SSEP and other actions. The six CEAAs and the rationale for the selection of each CEAA are described in Sections 4.20.2.1 through 4.20.2.7 and shown on Maps 30 and 31.

All CEAAs described below (except for climate change) are a mixture of BLM, state, and private lands. Public lands managed by BLM are used for a variety of purposes, including dispersed recreation, wildlife, livestock grazing, mining, and utility corridors for electric transmission lines and gas pipelines. Public lands are also managed for special values, including the Sonoran Desert National Monument and wilderness resources. State lands are typically managed for commercial uses that generate revenue for the benefit of Arizona's schools. Other state lands are managed with emphasis on management of wildlife and their habitat and recreation opportunities. Private lands in each CEAA have been developed for agricultural purposes, commercial and residential development, and public purposes such as roads, highways, landfills, and prisons. The lands in each CEAA are a mixture of undeveloped public lands, interspersed with cities and towns, roads and highways, agriculture, mining, utilities, and commercial development.

4.20.2.1 GLOBAL – CLIMATE CHANGE

Climate change and its effects are a global phenomenon; hence, the CCEA for climate change is the world. GHG emissions, from natural and human sources, that contribute to climate change are generally localized; however, their mixing and distribution in the atmosphere (globally) is what leads to the global extent of the problem. Because emissions of GHGs do not generally remain localized, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and RFAs that would produce or mitigate GHG emissions.

4.20.2.2 MARICOPA AND PINAL COUNTIES – SOCIOECONOMIC CONDITIONS

The CEAA for socioeconomics consists of Maricopa and Pinal counties (see Map 31). This CEAA is identical to the SESA discussed in Section 3.12.1 and 4.12.1 of this EIS (Socioeconomics). All data on socioeconomic conditions, fiscal conditions, public services and utilities, and environmental justice apply to the CEAA. This CEAA includes the population centers of the greater Phoenix area and the municipalities (cities or towns) of Goodyear, Buckeye, and Gila Bend. The approximate geographic dimensions of the two-county boundaries include lands 70 miles east and west of the Project Area, 40 miles north, and 65 miles south of Phoenix, for a total of approximately 9,342,720 acres. They include public, private, and state lands. These counties provide a reasonable area for analysis of the cumulative impacts to socioeconomics because they have similar suburban and rural character and are affected similarly, socially, and economically by land-use decisions. In addition, census and employment data are catalogued by county.

4.20.2.3 PROJECT AREA AND NONATTAINMENT AREAS FOR PM_{10} AND OZONE – AIR RESOURCES

The CEAA for air quality is the Project Area and the nonattainment areas for PM_{10} and ozone around Maricopa County (see Map 31). This CEAA was chosen because it is the extent of pollutant emissions regulations under the CAA. The CEAA totals approximately 3.2 million acres.

4.20.2.4 PROJECT AREA AND 5-KM RADIUS – NOISE

The CEAA for noise consists of the Project Area and all lands within a 5-km radius around the Project Area, for a total of 73,554 acres (see Map 31). The CEAA includes the northern portion of the Sonoran Desert National Monument, Buckeye Hills Regional Park, and low density residential areas to the east. There are several secondary roads in the 5-km CEAA, including Komatke, Riggs, and Haul roads. The size of the CEAA was chosen to capture other sources of noise that may overlap the dissipation distance noted and to better disclose cumulative impacts. The size is appropriate because construction noise usually dissipates to background levels within 2.8 km or 1.75 miles of the source[14], depending on topography and vegetation, intensity of the construction activities, and the range of ambient conditions.

[14] The assumption that noise usually dissipates to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA) and is the assumed distance for dissipation of noise to background levels for this analysis.

4.20.2.5 ARNOLD AND BELOAT GRAZING ALLOTMENTS – LIVESTOCK GRAZING

The CEAA for livestock grazing includes the Arnold and Beloat grazing allotments (see Map 30). Together they consist of 126,798 acres of BLM, state, and private lands. Vegetation communities on undeveloped lands in the allotments include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Agricultural lands are characterized by crops and pasturelands or fallow fields. The rationale for using this geographic scope for the livestock grazing analysis is that these are the only two allotments that would be affected by the Proposed Action and alternatives.

4.20.2.6 RAINBOW VALLEY SUB-BASIN – GROUNDWATER

The CEAA for groundwater is the Rainbow Valley Sub-basin (see Map 30). The Rainbow Valley Sub-basin encompasses an area of about 420 square miles (268,800 acres) and consists primarily of agricultural land in the north and undeveloped desert land in the south. Developed and privately owned agricultural land lies east of the undeveloped SSEP study area. The boundaries of the sub-basin are defined on the north by the Buckeye Hills and the northern part of the Sierra Estrella, on the west and southwest by the Maricopa Mountains, on the southeast by the Haley Hills, Booth Hills, and Palo Verde Mountains, and on the east by Sevenmile Mountain and the southern part of the Sierra Estrella (see Map 30). The sub-basin is drained by Waterman Wash, an ephemeral stream that flows northwest and joins the Gila River near Buckeye. This sub-basin would be the source of groundwater for the SSEP well field, and is the primary natural unit on which to assess impacts.

4.20.2.7 RAINBOW VALLEY (WATERMAN WASH AND RAINBOW WASH WATERSHEDS COMBINED) – ALL OTHER RESOURCE VALUES/USES

The CEAA for all other resources (listed below) is the Rainbow Valley (see Map 30). This CEAA covers 312,499 acres and is defined as the Waterman Wash watershed and the Rainbow Wash watershed, bounded generally by the Buckeye Hills and the Gila River to the north, the Maricopa Mountains on the south and west, and the Sierra Estrella Mountains on the east. Waterman Wash drains into the Gila River on the north and the Rainbow Wash drains into the Gila River to the west of the CEAA.

Table 4.117 identifies the rationale for the selection of the Rainbow Valley as the CEAA for these resources.

Table 4.117 Rationale for Rainbow Valley CEAA by Resource

Resource	Rationale for Rainbow Valley CEAA
Soils	Several soil types (predominantly the Denure-Rilito-Why complex) dominate the Project Area. These fan terrace/alluvial soils only extend along the valley bottom, and thus form a more or less continuous unit within the valley.
Geology and paleontological resources	This is the area of current subsidence due to groundwater pumping for irrigation. This is also the aquifer that would supply the water needed for the SSEP.
Minerals	Sand and gravel operations are found throughout the Phoenix Valley. The mineral resource within this area is under similar development pressure and management, and is essentially a local resource.
Surface Water	Two on-site washes; impact to total watershed should be restricted to flow into/from these watersheds. Direct impacts to a larger watershed (i.e., Gila River) are unlikely.
Vegetation	Similar slopes and soils within the Rainbow Valley; discrete "block" of similar habitat, bounded on all sides by other habitat types.
Wildlife	Contiguous habitat and movement (linkage) corridors.
Cultural	Encompasses viewsheds, related prehistoric activity similar to that in the Project Area, and TCPs and other areas of concern.
Visual resources	Adjacent peaks are recreation (hiking) destinations and located in sensitive areas where the view (recreation setting/experience) would be affected.
Land use	These are the municipalities most likely to be affected by similar land uses and development types, including residential development, transportation/infrastructure, mining (sand and gravel), grazing, landfills, prisons, and other energy projects.
Transportation and traffic	Includes the primary transportation system to the SSEP.
Recreation	The recreation use within this area is managed in a similar manner (generally dispersed and undeveloped), and is under similar pressures from other land uses and developments; representing a total impact on regional recreational opportunities (county trails, state recreation areas).
Special designation areas	There would be no physical effect on lands within the SNDM or nearby wilderness. The anticipated effects would be on wildlife that travel the linkage corridors across the Project Area to adjacent special designation areas, and the recreation setting and experience in these special designation areas.
Hazardous materials	Includes primary disposal sites for material used and generated at the SSEP.

4.20.3 Reasonably Foreseeable Actions

This section of the EIS identifies key ongoing, proposed, and potential actions within each CEAA that may result in incremental impacts or synergistic effects if implemented in combination with the alternatives considered in the EIS. Table 4.118 identifies the planning documents, studies, records, cities, agency websites, and agency staff consulted in determining the pertinent existing and RFAs.

Table 4.118 Sources Consulted for Development of Reasonably Foreseeable Actions

BLM in house search of pending applications
Records search at the Arizona State Lands Department
The Interstate 10/Hassayampa Valley Roadway Framework Study
Katie Wilkin (City of Goodyear planner)
The Southwest Area Transportation Study report (2003)
Final Lower Gila South Resource Management Plan and Environmental Impact Statement (1986)
Records search of the Land and Mineral Legacy Rehost 2000 System
Joe Schmitz (principal planner with City of Goodyear)
Rick Buss (City Manager and Principal Planner from the Town of Gila Bend)
Tom Dixon (Town of Buckeye planner)
Goodyear's Planned Area Developments table
Estrella III Major General Plan Amendment map
City of Goodyear General Plan 2003-2013
Town of Buckeye General Plan 2008a
LR2000 records search
Town of Buckeye Parks, Trails and Open Space Master Plan (2005)
Maricopa County Park's website
Arizona Game and Fish's website
Maricopa County Regional Trail System Plan (2004)
ADWR Designated Assured Water Supply Records
Maricopa County's State Route 85 Corridor Area Plan (2003)

For analysis purposes, the RFAs and development projections identified below come from the planning documents, studies, records, agencies, and staff consulted as identified above in Table 4.118. It should be noted that most of these plans are not yet complete. Use of these action plans does not intend to imply those actions are final decisions; rather, they are reasonably foreseeable assumptions for this cumulative impacts analysis. Further, the projections are not to be considered part of the Proposed Action, or alternatives, to this proposal. Table 4.119 identifies the RFAs identified for each CEAA and Map 32 identifies the approximate locations of these actions in relation to the SSEP. The cumulative analysis of impacts to groundwater resources incorporated complex modeling. RFAs had to be considered separately for groundwater to meet the needs of the modeling approach, as explained in Section 4.20.4.17 below.

As previously mentioned, in any NEPA analysis, it is preferable to quantify the assessment of effects (changes) on each affected resource. Table 4.119 details acreages of RFAs where it is appropriate (and possible) to quantify by acreage. If quantification by acreage is not appropriate (or possible), the table states if the RFA occurs within the CEAA or not.

Table 4.119 Reasonably Foreseeable Actions (expressed in acres) within Each Cumulative Effects Analysis Area

Reasonably Foreseeable Actions	Rainbow Valley CEAA	Rainbow Valley Sub-basin CEAA	Grazing CEAA	5-km CEAA	Air Quality Nonattainment Areas	Maricopa and Pinal Counties CEAA
Mining						
Wesco Mine	56.2	0	56.2	56.2	In	In
Mining Total	***56.2***	***0***	***56.2***	***56.2***		
Master Planned Communities (MPC)						
Arnold Baker Farm	332.5	332.5	332.5	0.0	In	In
*Estrella Highlands	1,217.1	1,217.1	1,217.1	1,217.1	In	In
Estrella Region I	2,807.1	2,807.1	11,391.5	190.9	In	In
*Madeira	2,369.5	2,369.5	2,369.5	1,874.1	In	In
*McRae Holdings	2,379.5	2,379.5	2,379.5	1,855.8	In	In
Rainbow Ranch	1,631.2	1,631.2	1,631.2	1,608.7	In	In
Rainbow Valley	868.4	868.4	868.4	294.0	In	In
Terrasante	892.4	892.4	892.4	202.9	In	In
Copper Falls	0.00	0.00	0.00	0.00	In	In
Blue Horizons	0.00	0.00	0.00	0.00	In	In
Southwest Ranch	0.00	0.00	0.00	0.00	In	In
Sundance	0.00	0.00	0.00	0.00	In	In
Desert Creek	0.00	0.00	0.00	0.00	In	In
Silver Rock	0.00	0.00	0.00	0.00	In	In
Westwind	0.00	0.00	0.00	0.00	In	In
Westpark	0.00	0.00	0.00	0.00	In	In
Sonoran Trails	0.00	0.00	0.00	0.00	Out	In
Dos Lagos	0.00	0.00	0.00	0.00	In	In
Ski Lakes	0.00	0.00	0.00	0.00	In	In
	0.00	0.00	0.00	0.00	Out	In
MPC Total	***12,497.8***	***12,497.8***	***21,082.1***	***7,243.3***		
Recreation						
Buckeye Trail corridors	49.8	13.7	38.9	50.8	In	In
Maricopa Regional Trails	81.8	43.6	63.7	55.0	In	In
Recreation Total	***131.5***	***57.3***	***102.5***	***105.8***		
Solar						
Mobile	3,569.0	3,569.0	0.0	0.0	In	In
Solar Reserve	0.0	0.0	0.0	0.0	Out	In
Solana – Abengoa Solar	0.00	0.00	0.00	0.00	Out	In

Table 4.119 Reasonably Foreseeable Actions (expressed in acres) within Each Cumulative Effects Analysis Area

Reasonably Foreseeable Actions	Rainbow Valley CEAA	Rainbow Valley Sub-basin CEAA	Grazing CEAA	5-km CEAA	Air Quality Nonattainment Areas	Maricopa and Pinal Counties CEAA
Res America	0.00	0.00	0.00	0.00	In	In
LS Power	0.00	0.00	0.00	0.00	In	In
Ausra AZ–II	0.0	0.0	0.0	0.00	Out	In
Solar Total	***3,569.0***	***3,569.0***	***0.00***	***0.00***		
Transportation						
Hassayampa Freeway	1,243.0	913.2	805.7	600.1	In	In
Sonoran Valley Parkway	420.6	420.6	548.5	218.0	In	In
Transportation Total	***1,663.6***	***1,333.8***	***1,354.2***	***818.1***		
Grand Total	**17,918.0**	**17,457.8**	**22,595.0**	**8,233.4**		

*Water withdrawals from these MPCs were considered RFAs for cumulative groundwater impacts because they have been issued Assured Water Supply determinations from ADWR.

4.20.4 Cumulative Impacts Related to the Proposed Action and Alternatives

4.20.4.1 AIR QUALITY

4.20.4.1.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for air quality is the Project Area and a 50-km radius around the Project Area, as described in Section 4.20.2. The past and present land uses in the CEAA have had a substantial effect on air quality in the CEAA. The CEAA is located in Maricopa County, a serious nonattainment area for $PM_{10}$and nonattainment area for 8-hour ozone. The CEAA is managed to prevent exceedances of NAAQS, and to improve air quality. However, background data from the Buckeye monitoring station indicate routine exceedances of 24-hour PM_{10} and $PM_{2.5}$ standards. Emissions from present land uses in the CEAA continue to contribute to these exceedances.

RFAs in the PM_{10} and ozone nonattainment areas over the next 30 years would be expected to result in additional emissions to the Maricopa County serious nonattainment area for PM_{10} and the nonattainment area for ozone. Construction and operation of the RFAs included in Table 4.119 would be permitted and mitigated in accordance with the SIP and CAA to ensure that they do not cause or contribute to exceedances of NAAQS.

Under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, construction and operation of the SSEP would result in additional emissions of criteria pollutants. However, emissions from the SSEP would be below the major source threshold for all criteria pollutants, and all air emissions would be appropriately mitigated to comply with the CAA, MACQD Air Pollution Control Regulations, and the Arizona SIP. Therefore, the project would not contribute to existing exceedances of NAAQS in the region.

4.20.4.1.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on air quality as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.2 CLIMATE CHANGE

4.20.4.2.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for climate change is the world, as described in Section 4.20.2.1. However, data are available to show the likely effects of climate change on the Southwest region of the United States. Therefore, the cumulative impacts from climate change are also considered at this scale.

Emissions of GHGs do not generally remain localized, but become well mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that would produce or mitigate GHG emissions. Although the SSEP would serve as a net mitigation for global climate change under all action alternatives, it is not possible to quantify the amount of mitigation that would occur on a global scale. However, current research suggests that climate change would have several irreversible impacts on the Southwest region.

Temperature levels in the Southwest are anticipated to rise as a result of global climate change. By 2020 temperatures could rise by approximately 1.7°F to 3.0°F, and by 2090 they could rise by approximately 3.8°F to 10.2°F. Overall precipitation levels in the Southwest are anticipated to fall as a result of global climate change. The higher temperatures and lower precipitation would likely lead to an increased risk of drought, wildfire, and flash flooding.

The construction of new sources of renewable energy production within the AZNM eGrid subregion would reduce the GHG emissions intensity of AZNM grid electricity, and would therefore reduce the GHG emissions savings of the SSEP versus the grid. However, it is not known to what extent such projects will be built. Therefore, the associated reduction in GHG emissions savings cannot be estimated at this time. In the absence of strong policy or regulatory drivers impacting the United States energy infrastructure, it is not anticipated that the generation mix of the AZNM subregion will change dramatically over the lifetime of the SSEP.

With net negative lifetime GHG emissions levels, all alternatives under which the SSEP is constructed, as well as other potential solar projects under the reasonably foreseeable developments, would serve as a net mitigation of the irreversible climate change impacts.

4.20.4.2.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on climate change as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.3 CULTURAL RESOURCES

4.20.4.3.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for cultural resources is the Rainbow Valley, as described in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on cultural resource values in the CEAA. Direct effects have included the loss, disturbance, theft, and burial of cultural artifacts and sites, as well as the modification and alteration of the setting of cultural sites and resources. Although surveys are conducted prior to development on state and federal lands to determine the presence of cultural resources sites eligible for listing on the NRHP (Section 106 NHPA), information may not be captured or sites protected from disturbance on private lands. If eligible sites are found, mitigation is implemented prior to construction to avoid sites or record (including excavation) the information from the sites prior to disturbance.

The development of private, state, and public lands for multiple purposes has lead to the recordation of information about previous cultures that occupied or traveled through the CEAA. Development of these lands has led to the collection of information about previous cultures, but also the physical loss of cultural resources sites in the CEAA.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in the disturbance of 17,918 acres (6% of the CEAA) and multiple consequences to cultural resources in the Rainbow Valley CEAA. Where these actions would occur on state and public lands, surveys prior to construction would identify the presence of cultural resources and eligible sites prior to surface disturbance for construction. These surveys would provide for mitigation measures needed to capture the information these sites provide before construction and disturbance or removal of the affected sites. Although physical sites would be lost, the information these sites provide about previous cultures would be recorded before construction. Development on private land does not require the same survey and mitigation, and information about sites and cultures on these lands may be lost. Ultimately, the result would be the collection of additional information about previous cultures and site, but the loss of the physical presence of other sites.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would result in up to a 20% growth in development in the Rainbow Valley CEAA over the next 30 years and contribute to the loss of site integrity of two sites in proximity to the Project Area. The construction and presence of the solar-generating facility would also alter the natural setting that contributes to the relevance of the setting to these sites. Further, one site is located in the Project Area and would be physically lost to development of the SSEP. Prior to construction, however, the information the site provides would be recorded.

4.20.4.3.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on cultural resources as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in the modification of site integrity of three sites dues to grazing and trailing disturbance by cattle. However, no sites would be physically lost to disturbance resulting from construction or operation of the SSEP.

4.20.4.4 GEOLOGY AND MINERALS

4.20.4.4.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for geology and minerals is the Rainbow Valley, as described in Section 4.20.2. The past and present activities within the Rainbow Valley have had direct impacts on the geology of the area due to terrain modifications that have resulted in a more consistent landform across the CEAA. Mining of sand and gravel resources is currently occurring within the CEAA, which removes the resource for use in other areas.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of the communities of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These actions, totaling 17,918 acres (6% of the CEAA), would cumulatively contribute to a more consistent landform across the CEAA. With the exception of the Wesco Mine that is currently developing sand and gravel resources, the RFAs could preclude mining of potential sand and gravel resources within the footprint of the actions.

Under the Proposed Action, construction and operation of the SSEP would cumulatively contribute 3,620 acres of disturbance to geologic resources (which represents 20% of the reasonably foreseeable developments and an additional 1.2% disturbance within the CEAA). Alternative A would contribute 3,609 acres (20% of the reasonably foreseeable developments and an additional 1.2% disturbance within the CEAA), Sub-alternative A1 would contribute 2,013 acres (11% of the reasonably foreseeable developments and an additional 0.6% disturbance within the CEAA), and Alternative B would contribute 2,394 acres (13% of the reasonably foreseeable developments and an additional 0.8% disturbance within the CEAA).

4.20.4.4.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on geology and minerals as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.5 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

4.20.4.5.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for hazardous materials and hazardous and solid waste is the Rainbow Valley, as described in Section 4.20.2. RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of the communities of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways, for a total of 17,918 acres (6% of the CEAA) (see Table 4.119). Other solar energy projects would be assumed to use similar types and amounts of hazardous materials and hazardous and solid waste. Other RFAs may produce unknown types and amounts of materials and wastes. The use of hazardous wastes and materials at SSEP would contribute to the cumulative use, transportation, and disposed of these wastes and materials in the CEAA.

The handling, transporting, and disposal of hazardous materials and hazardous and solid wastes are subject to stringent LORS under the EPA, ADEQ, AZSERC, and OSHA. Hazardous wastes generated during the construction and operation of any of the RFAs would be required to comply with these LORS. With adherence to these LORS, cumulative impacts from hazardous materials and hazardous and solid waste in the CEAA would be minimal.

4.20.4.5.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would generate, use, transport, and dispose of various hazardous materials and hazardous and solid wastes, however, the SSEP would not be constructed and would not contribute to the production, use or transportation of wastes.

4.20.4.6 LAND USE AND ACCESS

4.20.4.6.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for land use and access is the Rainbow Valley, as described above in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on the conversion of lands from one use to another and on the ability to access the area. Land in the Rainbow Valley is largely undeveloped and is characterized by vacant desert, agricultural lands, and by areas used for grazing mining, utilities, recreation, and widely dispersed, low-density residential development. Open desert and agricultural lands have been converted to residential, commercial, and industrial uses. Access has been altered by the addition of roads and utility corridors. Recreation use consists mostly of hiking, biking, and horseback riding; OHV use has been limited by the conversion of open lands to other uses. Grazing still occurs on most public land within the Rainbow Valley.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of solar facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments, totaling 17,918 acres (6% of the CEAA), would result in further changes to the type of land uses and would continue to alter access to the Rainbow Valley CEAA. The Hassayampa Freeway, a conceptual freeway alignment currently in the framework study stage of development (Interstate 8/Interstate 10 Hidden Valley Framework Study, [MAG 2009]), would be located within the designated corridor south of the SSEP. The Hassayampa Freeway, as currently depicted in the conceptual designs, would overlap with the southern portion of the solar field and the proposed access road and gen-tie line. When considered with past, present, and future action, this would result in an additive cumulative impact of changes to the existing land use of the designated corridor.

The Town of Buckeye's Parks, Trails, and Open Space Master Plan (Buckeye 2005) designates the Buckeye Hills region as having a strong potential for preserving the open space character currently exhibited in the CEAA between Buckeye Hills to the north and Sonoran Desert National Monument to the south. When considered with the Proposed Action, this would have a countervailing impact because the Proposed Action would be a conflicting land use with the potential of preserving open space.

Under the Proposed Action and Alternative A, the SSEP would convert approximately 3,620 acres and 3,609 acres, respectively, from open desert to an industrial site. This represents approximately 21% of the changes to land uses projected by RFAs over the next 30 years under both alternatives, which would impact an additional approximately 1.2% of lands within the CEAA. This would further reduce the amount of open space in which to recreate and graze cattle, but would increase the ability for nearby communities to get renewable energy. The conversion of approximately 3,620 acres (Proposed Action) and 3,609 acres (Alternative A) would result in an approximately 104% increase in the acreage of land in the CEAA used for renewable energy. Under Sub-alternative A1, the SSEP would convert 2,013 acres from open desert to an industrial site. This represents 11% of the projected change in land uses over the next 30 years (impacting an additional 0.6% of lands within the CEAA) and approximately a 56% increase in the acreage of land in the CEAA used for renewable energy. Under Alternative B, the SSEP

would convert 2,394 acres from open desert to an industrial site. This represents 13% of the projected change in land uses over the next 30 years (impacting an additional 0.7% of lands within the CEAA) and approximately a 65% increase in the acreage of land in the CEAA used for renewable energy.

4.20.4.6.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on land use as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing dispersed recreation, residential and commercial uses, and utility corridors would continue without land conversion to renewable energy.

4.20.4.7 LIVESTOCK GRAZING

4.20.4.7.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for livestock grazing includes the Arnold and Beloat grazing allotments, as describe in Section 4.20.2. Together they consist of 126,898 acres. Vegetation communities on undeveloped lands in the allotments include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Agricultural lands are characterized by crops and pasturelands or fallow fields.

The past and present land uses in the CEAA have had a direct effect on extent of grazing and the amount of forage in the area. Commercial and residential development has encroached on lands used for grazing and reduced the amount of land and forage available for cattle in the Beloat and Arnold allotments. Because of the type of vegetation communities and arid conditions of the CEAA, the Arnold allotment is only used for ephemeral grazing. The two allotments include 126,898 acres with authorized grazing of 122 AUMs.

RFAs in the livestock grazing CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 21,082 acres of lands for growth and expansion of master planned communities, construction of 102 acres of trails for the Town of Buckeye and Maricopa County, and construction of 1,354 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the vegetation communities that are used as forage for cattle grazing in the livestock grazing CEAA. Commercial development would result in the removal of vegetation communities and forage (both native and agricultural). The growth of master planned communities would convert more lands to structures and urban landscaping. And, construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. These RFAs would result in 22,595 additional acres of surface (including vegetation) disturbance in the CEAA, or an additional 18% of the CEAA.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the removal of forage from the livestock grazing CEAA over the next 30 years, further reducing forage in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of forage would be removed for construction of the SSEP. That is an approximately 16% contribution to the anticipated disturbance of all RFAs in the next 30 years under both alternatives, yielding an additional approximately 2.8% disturbance within the CEAA. Under Sub-alternative A1, removal of 2,013 acres of forage would contribute 9% of the anticipated forage reduction over the next 30 years (for an additional 1.6% disturbance within the CEAA). Under Alternative B, removal of 2,394 acres of forage would contribute 11% of the anticipated forage reduction over the next 30 years (for an additional 1.9% disturbance within the CEAA).

4.20.4.7.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on land use as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Existing livestock grazing would continue without land conversion to renewable energy.

4.20.4.8 NOISE

4.20.4.8.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for noise consists of the Project Area and all lands within a 5-km radius around the Project Area, as described in Section 4.20.2. The CEAA includes the northern portion of the Sonoran Desert National Monument, Buckeye Hills Regional Park, and low density residential areas to the east. There are several secondary roads in the 5-km CEAA, including Komatke, Riggs, and Haul roads.

Field observations indicate that there are very few area-wide noise sources that are noteworthy (such as local traffic, industrial, commercial, or agricultural sources). There are few daytime noise sources in the 5-km CEAA. SR-85 is nearly 8 miles away from areas with residential land uses. The nearest paved road is Rainbow Valley Road, a north-south, two-lane road that is 4.4 miles to the east of the eastern power block. All other roads near the Project Area, including Riggs Road, Pipeline Road, and all residential access roads, are dirt roads that are generally flat and well maintained. The noise environments in the recreational and residential areas are very similar and are dominated by the general background noise effects during most daytime hours. Typically, the lack of noise sources makes for an extremely quiet environment. Even during quiet periods, the traffic on SR-85 is not audible, and the noise environment was mainly influenced by insects and distant dogs. The summary of the ambient 24-hour L_{eq} long-term noise-level metrics indicates that a minimum of 39.7 dBA to a maximum of 47.6 dBA are produced in the area. A summary of the short-term data indicates a minimum L_{90}[15] of 22.1 dBA and a maximum of L_{10} of 66.0 dBA are produced in the area.

RFAs in the 5-km CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 7,243 acres of lands for growth and expansion of master planned communities, construction of 106 acres of trails for the Town of Buckeye and Maricopa County, development of the SSEP, and construction of 818 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the noise levels in the 5-km CEAA. Commercial and residential development along with the growth of master-planned communities and construction of freeways would bring more people and traffic to the area, which would result in an increase in noise levels in some areas. The projects that could occur directly adjacent to the SSEP, including the Wesco Mine expansion and Hassayampa Freeway, would result in the greatest cumulative impacts. However, because the SSEP would be in the operational phase during their operation and construction, its contribution to cumulative noise impacts would be relatively loud, as described earlier in Chapter 4. Relative to these new RFAs, the operation of SSEP would likely not be detectable, because it would be less loud than these sources during their construction (and potentially their operation). These RFAs would result in the conversion of 8,233 acres of open lands (11% of the CEAA) to other uses that would produce noise of varying levels. It is not possible to quantify the increase in dBA for these projects.

[15] The most common statistical sound levels used in community noise analyses are the L_{90}, L_{50}, and L_{10} levels. The L_{90} is the sound level exceeded 90% of the time and is often considered the effective background or residual noise level. The L_{50} is the sound level exceeded 50% of the time and is known as the median noise level. The L_{10} is the sound level exceeded 10% of the time and is a measurement of intrusive sounds (such as aircraft flying overhead), and is commonly known as the effective maximum or intrusive sound level.

Construction Noise Levels

Construction of the SSEP under all action alternatives would contribute to the increase in noise levels in the 5-km CEAA over the 37–39-month construction period. Under the Proposed Action and Alternative A, increases in noise levels during construction would be 20 dBA or less. The increases would range from 17 to 20 dBA at ST-2, 7 to 12 dBA at ST-3, 2 to 5 dBA at LT-1, and 2 to 4 dBA at LT-3. Ambient noise levels are greater than construction noise levels at noise receptors LT-3 and ST-1 by 7 and 25 dBA, respectively. Ground attenuation, vegetation, and topography would likely reduce these levels even further. See Table 4.54 (Predicted Construction Noise Levels Compared to Ambient Noise Levels for the Proposed Action) in Section 4.9 (Noise) for more information.

Under Sub-alternative A1, increases in noise levels during construction would be 12 dBA or less. The increases would range from 4 to 12 dBA at ST-2, 7 to 8 dBA at ST-3, and 1 to 2 dBA at LT-3. Ambient noise levels are greater than construction noise levels at noise receptors ST-1, LT-1, and LT-2. The maximum noise level at any of the receptor locations caused by construction would be 54 dBA at ST-2.

Operations Noise Levels

There would be an increase in daytime noise levels in the 5-km CEAA during operation of the SSEP at the ST-2 receptor. This would occur under all action alternatives except for Sub-alternative A1. Noise levels at the other receptors would remain below ambient conditions. The maximum noise level at ST-2 would be 42 dBA, or approximately 7–8 dBA above ambient conditions. Ground attenuation, vegetation, and topography would likely reduce these levels even further. There would be no increase in the ambient noise levels at the other receptors during operations.

Daytime noise levels would be below ambient conditions at all receptors under Sub-alternative A1. Nighttime noise levels during operations would be less than ambient levels under all alternatives. See Table 4.55 (Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action) and Table 4.57 (Predicted Operations Noise Levels Compared to Ambient Noise Levels – Sub-alternative A1) in Section 4.9 (Noise) for more information.

4.20.4.8.2 No Action

Existing noise sources in the area of analysis consist of sporadic vehicle traffic, small machinery, distant aircraft, and natural sounds from wind, rustling vegetation, birds, and insects. Under the No Action alternative, current ambient noise levels in the CEAA would continue to be influenced by these factors, and the sound conditions would remain quiet. The hourly average noise level (L_{eq}) recorded at Hayes Road was 47.6 L_{eq}, and sound conditions in the CEAA under the No Action alternative would not exceed this level.

4.20.4.9 PALEONTOLOGY

The low potential rating within the Project Area suggests that the presence of paleontological resources is unlikely. As such, there would be no anticipated short or long-term impacts to paleontological resources associated with construction and operation of the SSEP. Because there would be no direct or indirect impacts of construction and operation of the SSEP on fossils, there would be no contribution to the cumulative effects on paleontological resources in the CEAA.

4.20.4.10 RECREATION, WILDERNESS CHARACTERISTICS, AND SPECIAL DESIGNATIONS

4.20.4.10.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for recreation, wilderness characteristics, and special designations is the Rainbow Valley as described above in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on recreation opportunities, wilderness characteristics, and special designation values. The Sonoran Desert National Monument is managed to protect the biological, scientific, and historical resources. Lands with wilderness characteristics provide opportunities for solitude and primitive and unconfined recreation and to protect natural or undeveloped landscapes. Lands within the CEAA provide opportunities for dispersed recreation, including camping, hunting, wildlife observation, photography, backpacking, horseback riding, hiking, and backcountry driving. Low-density residential and agricultural developments have converted native shrub communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures. Commercial and residential developments have lead to surface disturbances and clearing of vegetation and planting of urban vegetation species, both native and non-native. Population growth has increased traffic and pressure in recreational areas. Although large parts of the CEAA remain undeveloped, the mixture of land use development has altered the land, its character, and the viewshed, especially in the valley.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). Except for the construction of trails, these developments of public, state, and private land would result in a loss of opportunities for dispersed recreation and would impact opportunities for solitude and primitive and unconfined recreation by affecting the visual resources of the recreation setting (creating more human developments) and the desired experience in the CEAA. Commercial development would result in the removal of vegetation communities (both native and agricultural) that would impact wildlife and reduce or change their habitat. The growth of adjacent cities and towns would convert more lands to structures and urban landscaping. Construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. Additional roads and structures reduce available habitat and block or alter wildlife movements.

This development would result in 17,918 additional acres (6% of the CEAA) converted from open lands to other uses in the CEAA, reducing opportunities for recreation and reducing or changing special area values. There would be, however, 132 acres of additional recreation opportunities from the construction of the Buckeye Trail corridors and the Maricopa Regional trails.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the development of the Rainbow Valley CEAA over the next 30 years and the continued alternation of the landscape and reduction of dispersed recreation activities and special area values in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of landform and native vegetation communities would be disturbed (leveled and removed) for construction of the SSEP. That would be an approximately 21% contribution to the anticipated landscape disturbance of all RFAs in the next 30 years (impacting an additional 1.2% of lands within the CEAA) under both alternatives. Under Sub-alternative A1, disturbance of 2,013 acres of the landscape would contribute 11% of the anticipated disturbance of all RFAs over the next 30 years (impacting an additional 0.6% of lands within the CEAA). Under Alternative B, disturbance of 2,394 acres of the landscape would contribute 13% of the anticipated disturbance of all RFAs over the next 30 years (impacting an additional 0.8% of lands within the CEAA).

The population in the Rainbow Valley is expected to grow and correspondingly the demand for areas in which to recreate. Conversion of public lands from open desert to other uses such as housing, energy development, and roadways would limit opportunities for dispersed, unconfined and primitive recreation, and solitude. Increased use in areas such as the Sonoran Desert National Monument, the Maricopa Wilderness Complex, Robbins Wildlife Refuge, and the Buckeye Hills Regional Park may create conflicts between users and impact vegetation, wildlife, and other wilderness and monument values. The SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the loss of dispersed recreation and special area values and contribute to the conversion of open lands to other uses.

4.20.4.10.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on recreation opportunities, lands with wilderness characteristic, and special designation values as described under the Proposed Action, Alternative A, Sub-alternative A1 and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and other uses would not result in any changes to recreation, wilderness character, or special designation area values.

4.20.4.11 SOCIOECONOMICS

4.20.4.11.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for socioeconomics is the combined area of Pinal and Maricopa counties, as described above in Section 4.20.2. This CEAA is identical to the SESA discussed in Sections 3.12.1 and 4.12.1 of this EIS (Socioeconomics). All data on socioeconomic conditions, fiscal conditions, public services and utilities, and environmental justice apply to the CEAA analysis. The past and present land uses in the CEAA have had a direct effect on socioeconomics of the CEAA through changes to employment (both types and amount), changes to the landscape which effect sense of place, increased housing availability, and changes to the overall population. Past and present actions have resulted in the current socioeconomic conditions in the CEAA, as described in Chapter 3.

In general, construction of RFAs within the two counties would create positive, temporary impacts on local economies and increased employment opportunities. RFAs would be expected to draw on the large regional construction workforce in the Phoenix area, where there is currently a considerable supply of qualified workers. Master planned communities would increase the housing availability within the CEAA, though currently there are a large number of vacant housing units available.

Concurrent construction of similar (reasonably foreseeable) projects in the future could result in a demand for labor that cannot be met by the region's labor pool, which could lead to an influx of nonlocal workers. This population increase could impact socioeconomic conditions and public services and utility.

From a lifestyle perspective, further development within the CEAA would change the landscape characteristics, existing landforms, and vegetation in the area which would contribute to an overall change in the sense of place for members of these counties. With the exception of the urban developed areas, the CEAA has a rural, moderately developed landscape. RFAs such as additional solar facilities, master planned communities, freeways and parkways could shift the landscape to a more developed landscape and would adversely impact local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience.

4.20.4.11.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on socioeconomics as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed and would not contribute to the socioeconomic changes within the CEAA.

4.20.4.12 SOILS

4.20.4.12.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for soils is the Rainbow Valley, as described in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on the soils within the CEAA from clearing of vegetation; diminished soil productivity from topsoil loss; erosion; and compaction, which leads to inability of water to infiltrate the soils.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further impacts to the soils occurring in the Rainbow Valley CEAA. These RFAs would result in 17,918 additional acres of surface disturbance in the CEAA, or an additional 6% of the CEAA.

Construction and operation of the SSEP under all action alternatives would contribute to the disturbance of soils from the Rainbow Valley CEAA over the next 30 years, increasing the potential for topsoil loss, erosion, compaction, and loss of productivity. Under the Proposed Action and Alternative A, 3,589 acres and 3,580 acres of soil disturbance, respectively, would occur during construction and operation of the SSEP, a 20% contribution to the anticipated disturbance of all RFAs in the next 30 years and an additional 1.1% disturbance within the CEAA. Under Sub-alternative A1, there would be 1,984 acres of disturbance to soils that would contribute 11% of the anticipated soil disturbance of all RFAs over the next 30 years and an additional 0.6% disturbance within the CEAA. Under Alternative B, there would be 2,363 acres of disturbance to soils that would contribute 13% of the anticipated soil disturbance of all RFAs over the next 30 years and an additional 0.8% disturbance within the CEAA.

4.20.4.12.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on soils as described under the Proposed Action, Alternative A, Sub-alternative A1 and Alternative B, except that the SSEP would not be constructed and would not further contribute to soils disturbance within the CEAA.

4.20.4.13 TRANSPORTATION AND TRAFFIC

4.20.4.13.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for transportation is the Rainbow Valley, as described in Section 4.20.2. The primary transportation corridor is SR-85. Other local-two lane roadways consist of Rainbow Valley and Riggs Road. Numerous improved and unimproved roads follow the section lines and half-section lines for access to dispersed agriculture and residential areas throughout the CEAA. The Komatke Road alignment and Haul Road are unimproved roadways used as access to existing utility facilities (i.e., switchyard) and the Wesco Mine. Several unimproved roads provide access from Komatke Road to the Sonoran Desert

National Monument. Roads, also used off-highway vehicle trails, are located along the BLM-designated utility corridors. The Southern Pacific railroad crosses the southern portion of CEAA from east to west for approximately 12 miles.

The past and present land uses in the CEAA have had a direct effect on the transportation in the Rainbow Valley CEAA. Commercial, industrial, and residential development related to population growth have added traffic to existing roadways and created the need for additional roads. However, LOS are still ranked at the LOS A and LOS B levels, which signify little or no congestion.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of solar facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments would result in further increases to the traffic volume and may reduce LOS (i.e., more congestion and delays). Construction of freeways and a parkway would improve traffic flows to some degree. The *Revised Interstate 8 and Interstate 10 Hidden Valley Roadway Framework Study* (MAG 2009) discusses the location of the conceptual Hassayampa Freeway, which would be primarily located within the BLM-designated utility corridor directly south of the Project Area. The Hassayampa Freeway, as currently depicted in the conceptual designs, would overlap with the southern portion of the solar field and the proposed access road and gen-tie line. The additive impact of this project to the Hassayampa Freeway would be adverse because the two proposals have overlapping project components (see Map 32). A traffic interchange at the SR-85 and Riggs Road intersection is no longer being considered in the 2011–2014 *State Transportation Improvement Program* (ADOT 2011). Commercial development would increase and concentrate traffic in particular areas, as would the growth of the master planned communities. Construction of other solar facilities would result in additional traffic, especially during construction.

Construction and operation of the SSEP under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B would contribute to the increase in traffic volume and alter the LOS. Under the Proposed Action and Alternatives A and B, there would be an increase of 1,000 vehicle trips to and from the construction site twice per day (AM and PM). The LOS would temporarily decrease from an LOS B or better to LOS B or worse during that time. These decreases in LOS and short-term impacts to traffic and transportation would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation. The additional operations traffic that would be generated by the SSEP after peak construction would have limited effect on the LOS of the existing project intersections. Construction and operation of the SSEP under these alternatives would contribute to the increases in traffic and decreases in levels of service during construction in the CEAA, but would return to existing levels during operations.

Under Sub-alternative A1, there would be an increase of 267 vehicle trips to and from the construction site twice per day (AM and PM). LOS would temporarily decrease from an LOS B or better to LOS C during AM peak traffic conditions on several SR-85 southbound and northbound mainline/Riggs Road intersections; otherwise, LOS would remain at an LOS B or higher. Decreases in LOS and short-term impacts to traffic and transportation would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation. The additional operations traffic that would be generated by the SSEP after peak construction would have limited effect on the LOS of the existing project intersections. Construction and operation of the SSEP under Sub-alternative A1 would contribute to increases in traffic and decreases in LOS during construction in the CEAA, but would return to existing levels during operations.

4.20.4.13.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on transportation as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed and would not contribute to changes in LOS. The transportation and traffic patterns and infrastructure in and around the Project Area would continue and grow, as described above, resulting in increased traffic volume and some change in LOS.

4.20.4.14 VEGETATION

4.20.4.14.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for vegetation is the Rainbow Valley, as described in Section 4.20.2. Vegetation communities on undeveloped lands in the valley include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Vegetation communities on the foothills and mountain slopes of adjacent mountain ranges include Sonoran Palo Verde Mixed Cacti/Sonoran Creosote-Bursage. Agricultural lands are characterized by crops and pasturelands or fallow fields. Vegetation typical of residential and commercial properties is characterized by urban landscaping, both native and non-native species.

The past and present land uses in the CEAA have had a direct effect on the extent and composition of native vegetation communities in the CEAA. Low-density residential and agricultural developments have converted native shrub communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures. Undeveloped lands retain their native vegetation communities, though some weeds have invaded. Commercial and residential developments have lead to clearing of vegetation and planting of urban vegetation species, both native and non-native.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the vegetation communities of the Rainbow Valley CEAA. Commercial development would result in the removal of vegetation communities (both native and agricultural). The growth of master planned communities would convert more lands to structures and urban landscaping. Construction of other solar facilities would result in the removal of further vegetation communities (both native and non-native). Construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. These RFAs would result in 17,918 additional acres of surface (including vegetation) disturbance in the CEAA, or an additional 6% of the CEAA.

Construction and operation of the SSEP under these alternatives would contribute to the removal of native and agricultural vegetation from the Rainbow Valley CEAA over the next 30 years, further reducing vegetation (both native and agricultural) cover in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of native vegetation communities would be removed for construction of the SSEP. That is an approximately 21% contribution to the anticipated disturbance of all RFAs in the next 30 years under both alternatives, which would impact an additional 1.2% of land within the CEAA. Under Sub-alternative A1, removal of 2,013 acres of native vegetation would contribute 11% of the anticipated vegetation disturbance of all RFAs over the next 30 years (an additional 0.6% of surface disturbance within the CEAA). Under Alternative B, removal of 2,394 acres of native vegetation would contribute 13% of the anticipated vegetation disturbance of all RFAs over the next 30 years (an additional 0.8% of surface disturbance within the CEAA).

4.20.4.14.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on vegetation as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in the use of vegetation for forage, but maintenance of rangeland health standards would limit further impacts to vegetation communities.

4.20.4.15 VISUAL RESOURCES

4.20.4.15.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for visual resources is the Rainbow Valley, as described in Section 4.20.2. The CEAA includes the Project Area viewshed (White Tank Mountains on the north, Maricopa Mountains on the south, Gila Bend Mountains on the west, and Sierra Estrella Mountains on the east). A brief qualitative discussion of visual changes to the Sonoran Desert landscape is also included.

The CEAA is a mixture of BLM, state, and private lands. Public lands managed by BLM are used for a variety of purposes including dispersed recreation, livestock grazing, mining, and utility corridors for electric transmission lines and gas pipelines. These are lands that are managed for some degree of landscape change to provide for uses that alter the characteristic landscape. Public lands in the CEAA are also managed for retention of undeveloped landscapes, including the Sonoran Desert National Monument and wilderness resources. State lands are typically managed for commercial uses that generate revenue for the benefit of Arizona's schools, often resulting in development that changes the character of the landscape. Private lands in the CEAA have been developed for agricultural purposes, low-density residential development, and public purposes such as landfills and prisons. The lands in the CEAA are a mixture of undeveloped landscapes, interspersed with agricultural, mining, utility, public purposes, and residential development, uses that alter the land and its character. The past and present land uses in the CEAA have resulted in the current landscape character of the CEAA.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further alteration and development of a landscape that is a mixture of agricultural lands, residential development, commercial uses, roads and highways, and undeveloped lands (open space), resulting in 17,918 additional acres of landscape development, or alteration of an additional 6% the landscape area in the CEAA.

Construction and operation of the SSEP under these alternatives would contribute to the development of the Rainbow Valley CEAA over the next 30 years and the continued alternation of the landscape in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of semiprimitive desert landscape and existing (primarily native) vegetation communities would be disturbed (graded flat with all vegetation removed) for construction of the SSEP. The disturbance from those alternatives would equate to approximately 21% of the anticipated cumulative landscape disturbance from all RFAs over the next 30 years, resulting in an additional 1.2% disturbance within the CEAA. Under Sub-alternative A1, disturbance of 2,013 acres of the landscape would equate to an 11% contribution to the anticipated cumulative disturbance over the next 30 years and an additional 0.6% disturbance within the CEAA. Under Alternative B, disturbance of 2,394 acres of the landscape would equate to a 13% contribution to the anticipated cumulative disturbance over the next 30 years and

an additional 0.8% disturbance within the CEAA. There could also be glare visible from multiple facilities simultaneously, which could increase negative perceptions of visual impacts from the facilities, and in some situations, it could be distracting or cause visual discomfort to some viewers. On a larger spatial scale, the development of the SSEP would contribute to ongoing changes to the Sonoran Desert landscape of the southwestern United States and northern Mexico. Population growth in the region's communities (and in the southwest in general) continues to increase the amount of infrastructure (transmission lines, gas pipeline, water lines, roads, etc.) needed to support these communities. As the growth patterns of the desert southwest continue to evolve, the undeveloped character of the Sonoran Desert will likely continue to shift toward a greater composition of altered landscapes and a lesser composition of natural or undeveloped landscapes. The SSEP would contribute to that landscape change.

4.20.4.15.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on the characteristic landscape (visual resources) as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would not result in any substantial further cumulative alternation of the characteristic landscape (to landform, vegetation, water, or structures).

4.20.4.16 WATER RESOURCES–SURFACE WATER

4.20.4.16.1 Proposed Action and Alternative A

The CEAA for surface water is the Rainbow Valley CEAA, as defined in Section 4.20.2. This CEAA includes the Waterman Wash watershed and the Rainbow Wash watershed, as some of the precipitation that falls in these watershed flows to drainages that cross the Project Area, and these watersheds would be affected by the SSEP under the Proposed Action and all action alternatives.

Past and present land uses in the CEAA have directly affected surface water. Construction of roads, railroads, mines, utilities, landfills, prisons, and residences, and the development of lands for agricultural purposes have resulted in surface and vegetation disturbances that affect drainages and floodplains. Construction of these various developments has resulted in vegetation removal and leveling of landforms that has resulted in filling and re-routing of surface water drainages, alteration of floodplains, and increased sedimentation. Agricultural practices have created similar changes to vegetation and landform and resulted in the same types of effects on surface drainages and floodplains. In addition, construction of irrigation features and stock watering facilities has created surface waters. Although construction of stock tanks have created additional surface water (though often only seasonal), damming an ephemeral drainages to capture stormwater runoff also reduces surface water flow. Although parts of the CEAA have been developed for human uses, with the resulting impacts to surface drainages and floodplains, large parts of the CEAA are still undeveloped and exhibit unaltered, or less altered surface water flow and function.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways. These developments of public, state, and private land, totaling 17,918 acres (6% of the CEAA), would result in further changes to surface drainages and floodplains in the CEAA.

Assuming a drainage density of 0.012 linear mile/acre for the CEAA (Moody and Frazee 2009), 17,918 acres of anticipated disturbance of RFAs in the CEAA over the next 30 years would be expected to disturb 215 miles of surface drainages. Construction and operation of the SSEP under the Proposed Action and Alternative A would be expected to disturb an additional 40 miles of drainages, an increase of 19% in the CEAA above the expected disturbance of the RFAs. Construction and operation of the SSEP would also be expected to disturb 219 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.2 Sub-alternative A1

Under Sub-alternative Al, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface drainages and floodplains as described under the Proposed Action and Alternative A. Under this sub-alternative, however, construction and operation of the SSEP would be expected to disturb 20 miles of surface drainages, an increase of 9% above the expected disturbance to drainages from the RFAs in the CEAA. Under Sub-alternative A1, the SSEP would also disturb 4 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.3 Alternative B

Under Alternative B, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface drainages and floodplains as described under the Proposed Action and Alternative A. Under this alternative, however, construction and operation of the SSEP would be expected to disturb 26 miles of surface drainages, an increase of 12% above the expected disturbance to drainages from the RFAs in the CEAA. Under Alternative B, the SSEP would also be expected to disturb 112 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.4 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface water drainages as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B. However, under this alternative, the SSEP would not be constructed, and would not contribute to the cumulative effects to surface water drainages and floodplains in the CEAA. Continuation of existing livestock grazing and dispersed recreation uses would not result in any substantial cumulative effects to surface drainages or floodplains.

4.20.4.17 WATER RESOURCES–GROUNDWATER

4.20.4.17.1 Proposed Action

The CEAA for groundwater is the Rainbow Valley Sub-basin, as defined in Section 4.20.2. The Rainbow Valley Sub-basin contains the aquifer that would be affected by the development of the SSEP, and was used as the groundwater modeling domain for the cumulative assessment of groundwater impacts (Carr 2010).

Groundwater development in the sub-basin began in the early 1950s, and expanded through the 1960s to the early 1980s. In the 1980s, groundwater use began to decline as agricultural lands were taken out of production. Most of the groundwater use in the northern part of the sub-basin is currently used for agriculture irrigation, though less than in the 1960s and 1970s. Several wells are registered as domestic water supplies.

The past and present land uses in the CEAA have had a direct effect on groundwater (aquifer) levels and trends. Records show steady water levels declines from the 1950s to the 1980s as a result of groundwater development for agricultural purposes. Water levels in the northern part of the sub-basin have stabilized or increased since the 1980s due to decreased groundwater pumping for agriculture and recharge to the sub-basin. However, in the southern part of the sub-basin, groundwater levels have continued to decline because of continued agricultural pumping. The average, long-term water level decline for the sub-basin is about 1 foot per year. The average decline for the northwestern part of the sub-basin (location of the SSEP) is about 0.75 foot per year.

The cumulative analysis of impacts to groundwater resources incorporated complex modeling (Carr 2010). RFAs were considered separately for groundwater to meet the needs of the modeling approach. The ADWR's database of current demand and committed demand were used to develop the list of reasonably foreseeable future groundwater pumping for the cumulative impacts analysis modeling for groundwater (Golder 2010).

Current demand is defined by ADWR as the most recent year with reported groundwater pumping data in the *Wells 55 Database*. Although 2008 data are currently being compiled, it typically takes more than one year before the data are considered complete and uploaded to the database; therefore, current demand for the purpose of the model was based on pumping data from 2007.

Committed demand is defined by ADWR as groundwater that has been approved for future development through the Assured Water Supply (AWS) Program under various types of determinations, as well as recorded lots that are not yet supplied water from within the basin. Although groundwater pumping for the SSEP does not fall under the AWS Program, ADWR typically applies AWS criteria to demonstrate physical groundwater availability under other programs. Seven AWS determinations have been issued by ADWR within the Rainbow Valley Sub-basin:

- One Certificate of Assured Water Supply (CAWS)
- One Physical Availability Determination (PAD)
- One Designation of Assured Water Supply (DAWS)
- Four Analyses of Assured Water Supply (AAWS)

The CAWS was issued for Tangier Acres, a small eight-lot subdivision, prior to 1990. The water demand for the subdivision is considered by ADWR to be reflected within the sub-basin's existing hydrologic conditions and is not classified as committed demand. Therefore, the water demand was not simulated in the model.

A PAD was issued to Estrella Mountain Ranch in October 2002 and represents an acknowledgement by ADWR regarding the physical availability of groundwater at that time. PADs are not classified by ADWR as committed demand. Therefore, the water demand for the Estrella Mountain Ranch PAD was not simulated in the model.

In 2006 the City of Goodyear was issued a modification of the city's DAWS, which are issued to water providers based on the projected 100-year demand. Although the city has expanded their boundaries into the Rainbow Valley Sub-basin, the city does not currently withdraw groundwater from the sub-basin. Therefore, groundwater pumping under the city's DAWS is not applicable and was not simulated in the model. However, a number of the developments simulated in the model are included as part of the city's master plan and pending DAWS application (which is not yet considered "complete and correct", and was therefore not considered reasonably foreseeable).

The four AAWS, issued between 2005 and 2007, are for proposed master planned developments with a projected 100-year groundwater demand reserved for a period of 10 years while the project is under development. An AAWS is subject to specific conditions and restrictions which, if not met, will cause the AAWS to be revoked and/or expire if the groundwater is not committed. The four AAWS were issued for the Estrella Highlands, McRae Holdings, Madeira, and Broadstone Preserve developments.

Based on these RFAs, annual cumulative groundwater use in the CEAA would grow from 3,699 to 32,851 acre-feet per year over the life of the SSEP (30 years), not counting the additional withdrawal of the Proposed Action. The total cumulative withdrawal from the aquifer during the 30-year projected life of the SSEP would be 769,616 acre-feet, not counting the additional withdrawal of the Proposed Action.

As discussed in Section 4.18.2.11, groundwater is replenished into the Rainbow Valley aquifer from natural recharge at a rate of approximately 2,550 afy. At this rate, groundwater recharge would take approximately 1.5 years to naturally replenish one year's cumulative withdrawals under current conditions (not considering the SSEP project). Factoring in the reasonably foreseeable withdrawals expected over the life of the project (30 years), but not including SSEP withdrawals, it would take approximately 13 years to naturally replenish one year's cumulative groundwater withdrawals in the CEAA. For a discussion on replenishment rates associated with the groundwater withdrawals under each SSEP alternative, refer to Section 4.18.2.11 and Table 4.110.

The cumulative changes in depth to groundwater of the existing wells in the sub-basin, based on both reasonably foreseeable and SSEP water use, are displayed in Tables 4.120 and 4.121. Cumulative drawdown in individual wells would range from 5 to less than 125 feet (see Appendix F for drawdown information on each individual well). However, it is important to note that the analysis and modeling include withdrawals from other water users in the sub-basin, including a large agricultural well in the southern end of the sub-basin. Therefore, the total (cumulative) drawdown for many wells would likely result exclusively (or almost exclusively) because of pumping by other users, without any SSEP contribution to the drawdown.

Table 4.120 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,429 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
120–<125	1
105–110	1
100–105	4
95–100	3
90–95	1
85–90	7
80–85	16
75–80	50
70–75	45
65–70	21
60–65	22
55–60	21
50–55	22
45–50	23

Table 4.120 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,429 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
40–45	3
35–40	10
30–35	1
20–25	1
15–20	1
10–15	2
<10	43

Table 4.121 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,862 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
120–less than 125	1
105–110	2
100–105	3
95–100	3
90–95	3
85–90	21
80–85	49
75–80	33
70–75	29
65–70	16
60–65	18
55–60	23
50–55	16
45–50	20
40–45	3
35–40	10
30–35	1
20–25	1
15–20	1
10–15	2
<10	43

Construction and operation of the SSEP under the Proposed Action would require an additional 2,305–3,003 acre-feet per year of groundwater withdrawal from the sub-basin aquifer, depending on the amount of supplemental natural gas-fired electrical generation. This would result in an additional withdrawal of 69,150–90,102 acre-feet of groundwater withdrawal over the life of the project (30 years), which would require approximately 27–35 years of natural aquifer replenishment to offset. These withdrawals would represent a contribution of approximately 2–32 feet of the total drawdown shown in Tables 4.120 and 4.121.

Projected groundwater withdrawals from SSEP are subject to compliance with ADWR's Arizona Groundwater Code (A.R.S. Title 45, Chapter 2). The key requirements for the SSEP project are the need to obtain either a groundwater right or a groundwater withdrawal permit to pump groundwater, and the need to comply with ADWR well spacing requirements and well impact requirements. The groundwater withdrawal permit pertinent to the SSEP is a GIU permit (A.R.S. § 45-515), which allows groundwater to be withdrawn "from a point outside of the exterior boundaries of the service area of a city, town, or private water company for a GIU outside of the exterior boundaries of such service area," subject to specific conditions. In its application to ADWR for the GIU permit, SSEP demonstrated that the project would not cause the water level to decline to more than 1,000 feet bls over the planned life of the project, which is consistent with ADWR's assured water supply requirements for subdivisions. The SSEP GIU permit application has been approved by ADWR and includes stipulations to monitor and report groundwater withdrawals.

4.20.4.17.2 Alternative A

Under this alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 95% less water than the Proposed Action. The SSEP would require 116 to 151 acre-feet of groundwater withdrawal per year, or 3,484 to 4,549 acre-feet over the 30-year life of the project. The effects of the SSEP groundwater pumping under this alternative were not modeled, but can be expected to be considerably less than under the Proposed Action.

4.20.4.17.3 Sub-alternative A1

Under this sub-alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 97% less groundwater withdrawal than the Proposed Action. This sub-alternative would cumulatively require approximately 2,165 acre-feet of groundwater over the life of the project (33.25 years), which would require approximately one year of natural aquifer replenishment to offset. Cumulative drawdown in individual wells would be less than 1 foot after five years.

4.20.4.17.4 Alternative B

Under this alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 34% less groundwater withdrawal than the Proposed Action. This alternative would cumulatively require 45,535 to 60,101 acre-feet of groundwater over the life of the SSEP (30 years), depending on the amount of supplemental gas-fire electrical generation, which would require approximately 18–24 years of natural aquifer replenishment to offset. The effects of the SSEP groundwater pumping under this alternative were not modeled, but can be expected to be somewhat less than under the Proposed Action.

4.20.4.17.5 Brine Concentrator Option

The addition of the brine concentrator to the solar-generating facility would reduce both annual and life of project groundwater withdrawals by approximately 7%. The effects of the SSEP groundwater pumping assuming the adoption of this option were not modeled, but can be expected to slightly reduce the level of drawdown in the sub-basin.

4.20.4.17.6 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on groundwater as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in no changes to the groundwater reserves in the sub-basin or depth to groundwater of the existing wells.

4.20.4.18 WILDLIFE AND SPECIAL-STATUS SPECIES

4.20.4.18.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for wildlife is the Rainbow Valley, as described in Section 4.20.2. The lands in the CEAA are a mixture of undeveloped public lands, interspersed with agricultural, mining, utility, public purposes, and residential development. Vegetation communities on undeveloped lands in the valley include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Vegetation communities on the foothills and mountain slopes of adjacent mountain ranges include Sonoran Palo Verde Mixed Cacti/Sonoran Creosotebush-Bursage. Agricultural lands are characterized by crops and pasturelands or fallow fields. Vegetation typical of residential and commercial properties is characterized by urban landscaping, both native and non-native species. All of these vegetation communities provide habitat for a variety of mammals (large and small), birds, reptiles, and amphibians (see Section 3.19).

The past and present land uses in the CEAA have had a direct effect on the presence, extent, and composition of wildlife populations and their habitat in the CEAA. Commercial, residential, and agricultural development have converted native vegetation communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures, influencing their quality and availability to wildlife. Construction of roads and highways have reduced habitat, created barriers to wildlife movement, and increased the risk of mortality from vehicle collisions. The presence and noise of human habitation and activity throughout areas that have been converted to commercial, residential, and agricultural land uses (as described in Sections 4.20.4.8 [Noise] and 4.20.4.14 [Vegetation]) have reduced habitat quality for many wildlife species. However, much of the CEAA is still undeveloped and retains its native vegetation communities, including lands within the valley. These undeveloped valley lands provide important linkages between the mountain ranges in the CEAA, providing opportunities for dispersal, genetic viability, and continued habitat for many species.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land, totaling 17,918 acres (6% of the CEAA), would result in further changes to the quality of wildlife habitat of the Rainbow Valley CEAA, and the populations of species that depend upon that habitat. These developments would convert existing habitat (both native and human-modified) through vegetation clearing, construction of buildings, and construction of roads, power lines, and other utilities. Further, the RFAs would increase

human presence, noise, and activity on the landscape. All of these actions would change existing wildlife habitat and populations, diminishing the quality of habitat and wildlife populations dependent on those habitats for some species, and improving habitat and populations for others (i.e., those that favor some degree of human modified landscapes).

The Rainbow Valley CEAA is potential foraging habitat for migratory and nonbreeding golden eagles. The disturbance of an additional 17,918 acres of habitat, as described above, would decrease the availability of eagle prey populations (e.g., jackrabbits, snakes, small mammals), thereby potentially decreasing the presence of eagles in the CEAA. Although golden eagles are currently not known to nest within a 10-mile radius of the Project Area, power poles that would be erected concomitant with the type of development planned for the Rainbow Valley could be used as nesting structures, thereby benefiting local golden eagle populations by creating nesting habitat.

Construction and operation of the SSEP under the Proposed Action and Alternative A would contribute approximately 3,620 acres and 3,609 acres, respectively, to the anticipated future disturbance of wildlife habitat in the CEAA, or approximately 21% of the expected total disturbance, resulting in an additional 1.2% disturbance within the CEAA. They would also result in the loss of approximately 9 acres of the Gila Bend-Sonoran Desert National Monument linkage corridor, and 1,149 acres of the Buckeye Hills-Sonoran Desert National Monument linkage corridor, and their permanent bisection by a relatively low-use road (during operations). Both of these linkages would also be bisected by the proposed Hassayampa Freeway, with would result in an additional (and far less permeable) barrier to wildlife movement through these linkages. The cumulative effects of the RFAs are generally understood, but further research would be beneficial to fully understand the effects of various human developments on linkage corridors and wildlife movement through these corridors. Opportunities exist to study the effects of the SSEP and other development on wildlife and use of the corridors. This research would be helpful in defining measures needed to mitigate impacts to wildlife.

The cumulative impacts of displacement, habitat fragmentation, and barrier effects inside wildlife linkages could negatively affect the metapopulation of bighorn sheep located in southwestern Arizona. This metapopulation consists of small localized populations in islands of habitat located in the Buckeye Hills, Sierra Estrella Mountains, Gila Bend Mountains, and other nearby ranges. It is essential that bighorn individuals are able to move between populations for the purposes of genetic mixing. Blocking or otherwise affecting these movement patterns would further isolate populations and could ultimately lead to local extinctions if the degree of isolation were great enough. Presently, the Gila Bend-Sonoran Desert National Monument linkage is bisected by linear features such as SR-85 that likely impede bighorn sheep movement. The construction of additional linear features in this and the Buckeye Hills-Sonoran Desert National Monument linkage corridors, such as from the Proposed Action and the Hassayampa Freeway, would serve to further impede bighorn sheep movement. Movement could be impeded by increasing the probability of mortality from vehicle strikes and by generally increasing human noise and activity, which would displace bighorn sheep from an area surrounding the disturbance.

Under Sub-alternative A1, the SSEP would contribute 2,013 acres to the anticipated future disturbance to wildlife habitat in the CEAA, or approximately 11% of the expected total disturbance over the next 30 years (yielding an additional 0.6% disturbance within the CEAA). Sub-alternative A1 would result in the same cumulative impacts to wildlife linkage corridors as described for the Proposed Action because 100% of the linkage width would be impacted.

Under Alternative B, the SSEP would contribute 2,394 acres to the anticipated future disturbance to wildlife habitat in the CEAA, or approximately 13% of the expected total disturbance over the next 30 years (yielding an additional 0.8% disturbance within the CEAA). Alternative B would result in the same cumulate impacts to wildlife linkage corridors as described for the Proposed Action.

4.20.4.18.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on wildlife and their habitat as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in maintenance of habitat for wildlife and intermittent human disturbance to the wildlife using that habitat.

CHAPTER 5.
CONSULTATION AND COORDINATION

5 CONSULTATION AND COORDINATION

5.1 Introduction

CEQ regulations implementing NEPA require that federal agencies provide meaningful opportunities for the public and stakeholders to provide input and identify their concerns with regard to the EIS process. Federal laws, such as the ESA, the CWA, and the NHPA, mandate public involvement and consultation with agencies or federally recognized tribal governments.

This chapter documents the specific consultation and coordination efforts undertaken by the BLM throughout the entire process of developing the SSEP draft EIS. A complete list of agencies and individuals who received the draft EIS can be found in the administrative record.

5.2 Public Involvement

The BLM has taken a variety of steps to inform the public; special interest groups; and local, state, and federal agencies about the Proposed Action and alternatives for the SSEP, and to solicit feedback from these interested parties to help shape the scope and alternatives of this project. The following sections summarize the efforts taken to consult and coordinate with all interested persons, agencies, tribes, and organizations.

5.2.1 Public Scoping Meetings

As part of the NEPA requirements, a NOI to prepare the EIS was published in the *Federal Register* on July 8, 2009. Publication of the NOI initiated a 60-day, formal public and agency scoping period, during which the BLM solicited comments regarding the project and regarding its potential impacts.

Early in the scoping period, the BLM advertised the initiation of the EIS process through the BLM website, advertisements in the local newspapers, media releases, and direct mailings to 844 past project stakeholders, SSEP Project Area stakeholders, and special interest groups (environmental, elected officials, business interests, recreational, and tribal). Additionally, personal telephone calls were made to key stakeholders to provide project and scoping meeting information, and public meeting information was posted at various community outlets, such as community centers, libraries, grocery stores, city offices, and recreational outlets in Avondale, Goodyear, Buckeye, and Gila Bend. Public briefings were held with a variety of interest groups, agencies, etc. to inform them about the project. Table 5.1 includes a list of meetings that took place, the topics discussed, and meeting attendees.

Table 5.1 List of Meetings and Telephone Conversations, Meeting Topics, and Meeting Attendees – Scoping and Development of the Draft EIS

Date	Agency/Group	Discussion/Topic	BLM Attendees
April 24, 2009	BLM Arizona State Office	Discussion with the Governor's Office and industry representatives on BLM's strategy for processing solar ROW applications	Jim Kenna, Mike Taylor, Julie Decker, Joe Incardine, Kathleen Depukat, Solar Core Team
May 15, 2009	ADWR	Project overview	Joe Incardine, Julie Decker, Kathleen Depukat
May 19, 2009	Arizona Corporation Commission	Project overview and permitting	Joe Incardine
June 10, 2009	AZGFD	Project introduction and invitation to cooperate	Joe Incardine
July 14, 2009	Abengoa Solar	Project discussion with Kate Maracas	Joe Incardine
July 14, 2009	APS Lands Department	Project discussion with Ryan Jagels	Joe Incardine
July 15, 2009	EPA	Project discussion with Ann McPherson	Joe Incardine
July 23, 2009	Arizona Desert Bighorn Sheep Society	Project discussion with Brian Dolan	Joe Incardine
July 27, 2009	City of Goodyear	Project introduction with Joe Schmitz	Joe Incardine
July 27, 2009	APS	Project discussion with Ryan Jagels	Joe Incardine
July 30, 2009	ADEQ	Project overview with Paul Rasmussen	Joe Incardine
September 16, 2009	ADOT	Project discussion relating to traffic with Thor Anderson	Joe Incardine
September 17, 2009	ADEQ	Project and permitting discussion with David Lelsz	Joe Incardine
October 15, 2009	National Renewal Energy Laboratory	Project discussion on technology with Doug Dahle	Joe Incardine
November 4, 2009	ADEQ – Water Quality Division	Project discussion on permitting with David Lelsz, Linda Taunt, Carolette Winstead, Wendy Lestarge	Joe Incardine
December 22, 2009	Town of Buckeye	Project overview and EIS process	Joe Incardine, Emily Garber
January 31, 2010	City of Goodyear	Groundwater modeling	Joe Incardine, Jim Renthal
February 2, 2010	ADWR, City of Goodyear	Groundwater permitting	Joe Incardine, Jim Renthal
February 10, 2010	AZGFD, Sonoran Institute, The Wilderness Society, Friends of the Sonoran Desert Monument, The Sierra Club	AZGFD mitigation proposals	Joe Incardine, Tim Hughes

Table 5.1 List of Meetings and Telephone Conversations, Meeting Topics, and Meeting Attendees – Scoping and Development of the Draft EIS

Date	Agency/Group	Discussion/Topic	BLM Attendees
February 11, 2010	Town of Buckeye	Project overview and jurisdictional permitting	Joe Incardine, Emily Garber
February 16, 2010	SRP	Project discussion on technology with Dan Brickley, Mark Russell, Sr., Brian Keel, Luke O'Dwyer, Chuck Russell, Mark Russell, and Chuck Falls	Emily Garber, Kathleen Depukat, Chris Horyza, Eddie Arreola, Joe Incardine, Melissa Warren
March 23, 2010	BLM	Stormwater drainage	Kathleen Depukat, Terresa Reed, Julie Decker, Jim Renthal

The BLM held public and agency scoping meetings for the EIS in Phoenix, Arizona, on August 4, 2009, and public scoping meetings in Buckeye and Gila Bend, Arizona, on August 5 and 6, 2009, respectively. At each meeting, BLM, Boulevard, and project contractor staff members were on hand to provide information on project planning activities to date, and to answer questions. Meeting attendees were encouraged to provide written comments on the issues and alternatives to be analyzed in the EIS.

5.2.2 Scoping Report

A detailed description of the scoping process, planning issues derived from the comments, and analysis of the information received is contained in the BLM's October 2009 scoping report. The scoping report is available at the BLM LSFO or online at http://www.blm.gov/az/st/en/prog/energy/solar/sonoran_solar.html. The BLM received 93 scoping letters from individuals and businesses; federal, state, and local agencies; and nongovernmental organizations. Informal comments captured through the public scoping meeting notes were also included in the scoping report.

5.2.3 Meetings on the Draft EIS

As part of the NEPA requirements, NOAs of the draft EIS were published in the *Federal Register* by the EPA on April 9, 2010, and by the BLM on April 19, 2010. Publication of the EPA NOA initiated a 45-day, formal, public and agency comment period, during which the BLM solicited comments regarding the project, the alternatives analyzed, and potential environmental impacts.

Early in the comment period, the BLM advertised the publication of the draft EIS through the BLM website, advertisements in the local newspapers, media releases, and direct mailings to 850 past project stakeholders, SSEP Project Area stakeholders, special interest groups (environmental, elected officials, business interests, recreational, and tribal), and individuals who signed up for the mailing list at the scoping meetings or by other means. Additionally, personal telephone calls were made to key stakeholders to provide project information, and public meeting information was posted at various community outlets, such as community centers, libraries, grocery stores, city offices, and recreational outlets in Avondale, Goodyear, Buckeye, and Gila Bend. Table 5.2 provides a list of meetings that took place, the topics discussed, and meeting attendees.

Table 5.2 List of Meetings and Telephone Conversations, Meeting Topics, and Meeting Attendees – Public Comment Period on the Draft EIS

Date	Agency/Group	Discussion/Topic	BLM Attendees
April 2, 2010	BLM	Off-site air mitigation	Joe Incardine, Kathleen Depukat, Jim Renthal, Craig Nicholls, Scott Archer
April 20, 2010	BLM	Cultural resources and Section 106	Joe Incardine, Kathleen Depukat, Mike Johnson
April 26, 2010	Town of Buckeye	Draft EIS and water usage	Joe Incardine, Emily Garber
May 18, 2010	Town of Buckeye	MOU and draft EIS	Joe Incardine, Emily Garber
May 19, 2010	BLM	Identification of key decision points based on preliminary review of draft EIS comments.	Joe Incardine, Kathleen Depukat, Angelita Bulletts, Emily Garber, Chris Horyza
May 20, 2010	AZGFD	Relocation of kit fox/badgers/burrowing owls	Joe Incardine, Tim Hughes
May 25, 2010	Wild at Heart	Relocation of burrowing owls	Joe Incardine, Tim Hughes, Kathleen Depukat
May 25, 2010	EPA	Draft EIS comments	Joe Incardine
May 28, 2010	Arizona Corporation Commission	Draft EIS comments	Joe Incardine

A digital copy and/or hard copy of the draft EIS was mailed to 202 individuals, including federal key project stakeholders and those who responded to the direct mailings indicating that they wanted a copy. A hard copy of the draft EIS was made available for inspection at the BLM LSFO and public libraries in Buckeye, Gila Bend, and Goodyear, Arizona. A digital copy of the draft EIS was made available on the BLM's website.

The BLM held agency and public meetings to discuss the draft EIS in Phoenix, Arizona, on April 27, 2010, and public meetings in Gila Bend and Buckeye, Arizona, on April 28 and 29, 2011, respectively. At each meeting, BLM, Boulevard, and project contractor staff members were on hand to provide information on project planning activities to date, and to answer questions regarding the content of the draft EIS. Meeting attendees were encouraged to provide written comments on the issues and alternatives analyzed in the draft EIS.

5.2.4 Project Newsletter

On May 16, 2011, a project newsletter was sent to 748 past project stakeholders, SSEP Project Area stakeholders, special interest groups (environmental, elected officials, business interests, recreation, and tribal), and individuals who signed up for the mailing list at the public meetings or by other means. The newsletter contained an overview of the Proposed Action, the alternatives analyzed in the draft EIS, and the addition of PV technology as a sub-alternative (Sub-alternative A1) for further study. The newsletter was presented at the May 4, 2011, Resource Advisory Council meeting prior to being distributed to the entities indicated above.

5.2.5 Responding to Comments on the Draft EIS

The BLM received a total of 161 comment letters on the draft EIS, as follows:

- 83 form letters sent by individuals using a letter generator originating from the Sierra Club (a nongovernmental organization)
- Two "form-plus letters," that is, a copy of the form letter described above, with additional text added
- 76 unique letters

Letters were received through submissions via the BLM webform, public meeting comment cards, letters, and emails. The 76 unique letters were from the following entities:

- Seven submissions from businesses, including one submission from the project proponent, Boulevard
- Three submissions from eight nongovernmental organizations (Wildlife Society, Western Lands Project, and a letter from the Wilderness Society's BLM Action Center sent on behalf of the Wilderness Society, Sierra Club-Grand Canyon Chapter, Friends of the Sonoran Desert Museum, Sonoran Institute, Tonopah Area Coalition, and Defenders of Wildlife)
- Seven submissions from federal agencies (Prescott National Forest, U.S. Senator Jon Kyl, BLM Phoenix District Office; and four submissions from the EPA)
- Seven submissions from State of Arizona agencies (one submission each from the AZGFD, ADWR, ADOT, and ADEQ Water Division; and three submissions from ADEQ's Air Quality Division)
- Seven submissions from regional and local entities (one submission each from the Maricopa County Association of Governments and the Maricopa County Parks and Recreation, two submissions from the City of Goodyear, and three submissions from the Town of Buckeye)
- Two tribal submissions (the Hopi Tribe and the Tohono O'odham Nation)
- 43 individual submissions (not including the two "form-plus" submissions)

In preparing the final EIS, the BLM considered all comments to the extent practicable. Appendix A (Response to Comments) contains each unique comment received and its associated response. The appendix also contains a description of the comment analysis and response process.

5.2.6 Public Comment Period on the Final EIS

There will be a 30-day review and comment period on the final EIS. Any written comments received during this period will be considered prior to the ROD.

5.3 Agency Coordination/Consultation

5.3.1 U.S. Fish and Wildlife Service

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction of their designated critical habitat. It also requires consultation with the USFWS in making that determination.

The BLM initiated informal consultation with the USFWS under Section 7(a) (2) of the ESA on July 8, 2009, requesting from the Arizona Ecological Services Field Office of the USFWS a list of endangered or threatened species (or species proposed for listing) that may occur in the Project Area or be affected by SSEP construction. The list was provided by the USFWS in a letter dated August 11, 2009.

A BA was prepared to determine if the development and/or operation of the SSEP would have any effects on species included in the list provided by the USFWS. The BA was submitted to the USFWS on December 8, 2009. The USFWS responded on January 11, 2010, issuing its concurrence that no adverse effects are likely to occur to the species listed and indicating that no further consultation with the USFWS would be required at this time. In its concurrence letter, the USFWS recommended that a groundwater monitoring plan be established and implemented to track and confirm that the SSEP would have no unanticipated effects on the Gila River. Copies of the August 11, 2009, species list letter and the January 11, 2010, concurrence letter are included in Appendix B (Consultation Letters).

5.3.2 U.S. Army Corps of Engineers

The USACE was contacted on September 4, 2009, for an approved Department of the Army JD for the Project Area. Clarification was requested from the USACE on whether the SSEP would require a Section 404 permit under the CWA. Section 404 regulates the discharge of dredged or fill material into waters of the United States, including wetlands and other special aquatic sites. The USACE indicated that the Project Area does not contain any waters of the United States, and thus no Section 404 permit would be required for the discharge of dredged or fill material associated with the SSEP. The USACE's formal responses to both determinations are contained as separate letters in Appendix B.

5.3.3 Cooperating Agency Involvement

In July 2009, the BLM invited 20 federal, state, and local entities to participate in the project as cooperating agencies. To date, cooperating agency status has been extended to the Town of Buckeye, City of Goodyear, and AZGFD. MOUs outlining the roles and responsibilities of each agency in preparation of the EIS have been prepared. The USACE initially accepted the cooperating agency invitation, but upon determination that the Project Area did not contain any waters of the United States and would not require a Section 404 permit, they notified SSEP project managers that there was no longer a need for them to be a cooperating agency for the project. The BLM informally engaged the ADWR throughout preparation of the draft EIS for guidance on State of Arizona permitting requirements and input on the development of the NEPA analysis. The ADWR became a formal cooperating agency in March 2011 (following issuance of the draft EIS and prior to publication of this final EIS).

5.3.4 Arizona Game and Fish Department

Throughout project planning, Boulevard consulted with AZGFD regarding potential impacts to wildlife species that are not threatened or endangered but that are of interest to AZGFD. AZGFD initially provided Boulevard with two research proposals that would be considered mitigation for impacts to wildlife. They also provided a third proposal to conduct pre-construction wildlife clearance surveys for various species. Boulevard and AZGFD are finalizing discussions regarding research proposals and mitigation, with Boulevard supporting the AZGFD proposed wildlife clearance surveys. The anticipated outcome of these discussions is an MOU outlining the agreed-upon actions and funding. The finalized MOU will be provided to BLM when agreement is reached between Boulevard and AZGDF, and may be attached to the ROD.

Additionally, AZGFD's initial proposals were provided to both BLM and interested local environmental organizations (Sierra Club, Sonoran Institute, Friends of the Sonoran Desert National Monument, etc.) for input and feedback. BLM has also been apprised of the most recent discussions and proposals provided by AZGFD, which specifically address Sub-alternative A1.

5.4 Government-to-government Consultation

The BLM is engaged in formal, government-to-government consultation with several federally recognized tribes with interest in the SSEP. Consultation with tribes is required under Section 106 of the NHPA, as well as NEPA and other laws and EOs. Section 106 of the NHPA requires that federal agencies consider the effects of their actions on historic properties, following regulations in 36 CFR § 800. Agencies must also consider effects on places of traditional cultural and religious importance. Historic properties under the NHPA are cultural resources that are included in the NRHP or that meet the criteria for the NRHP. Section 106 of the NHPA requires that federal agencies consult with the appropriate SHPO and Tribal Historic Preservation Officer (THPO) if they (the federal agencies) determine that activities under their control could affect historic properties. Under NHPA, any adverse effects to NRHP-eligible properties are to be resolved through consultations that identify appropriate mitigation and treatment measures.

The BLM formally initiated Section 106 consultation with the Arizona SHPO on October 1, 2009. In its initiation letter, the BLM identified the APE and clarified that a Class III cultural resources survey of the entire APE would be conducted. A copy of this correspondence is included in Appendix B. The BLM accepted the Class III cultural resources survey. Both the report and BLM's recommendations of eligibility were forwarded to the SHPO for further consultation in February 2010. By letter dated March 22, 2010, SHPO concurred with the BLM's determination that three archaeological sites in the APE are eligible for the NRHP. A letter dated April 11, 2011, was sent to the SHPO updating them on the addition of Sub-alternative A1 for detailed analysis in the final EIS, and recommending a determination of adverse effect. The SHPO responded by a letter dated April 29, 2011, reiterating the eligibility of the three sites, concurring with the adverse effect determination and recommending a memorandum of agreement (MOA) and data recovery plan to resolve the direct adverse effect on the unavoidable site, with monitoring of the two sites to be avoided by construction and operations. . The SHPO provided comments on a draft version of the MOA on August 22, 2011. The BLM is working with the SHPO and other consulting parties to finalize the MOA and a historic properties treatment plan that will address procedures for data recovery, monitoring, and unanticipated discoveries. As required, a notification of adverse effect determination was sent to the Advisory Council on Historic Preservation on July 20, 2011, inviting the council to participate in development of the MOA. The ACHP responded on August 5, 2011, and declined to participate as a formal signatory to the MOA.

The BLM initiated formal consultation with tribes through consultation letters sent on July 7, 2009, to the following eight federally recognized tribes: Ak Chin Indian Community, Fort McDowell Yavapai Nation, Gila River Indian Community, Hopi Tribe, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, Tohono O'odham Nation, and the Yavapai-Prescott Indian Tribe. The Hopi Tribe responded in writing, requesting a copy of the cultural resources survey and indicating that they would continue formal consultation if any prehistoric cultural resources would be adversely affected by the project. A copy of the Hopi Tribe letter is included in Appendix B. In February 2010, the tribes were provided copies of the survey report and draft EIS for review and comment. A letter dated April 11, 2011, was sent to the tribes updating them on the addition of Sub-alternative A1 for detailed analysis in the final EIS, reviewing determinations of eligibility (with which several tribes had concurred), and addressing a proposed determination of adverse effect. Responses were received from the Hopi Tribe, the Yavapai-Prescott Indian Tribe, the Tohono O'odham Nation, and the Gila River Indian Community. A letter

requesting tribal participation in the MOA was sent to the tribes on July 12, 2011, with a copy of a preliminary draft MOA. Tribal consultations will continue through the development and implementation of the MOA and a historic properties treatment plan (which will include a data recovery plan).

5.4.1 Specific Consultation Actions

The BLM initiated government-to-government consultation with eight federally recognized Indian tribes (listed in Section 5.4) beginning in July 2009. Consultation is ongoing and has taken place through letters, telephone calls, face-to-face meetings, and electronic mail. Six tribes responded and requested continuing consultations and opportunities to review documents and matters relating to cultural resources. The Fort McDowell Yavapai Nation stated that it had no issues and would defer participation to the Gila River and Ak-Chin communities. Despite follow-up contacts from the BLM, no response was received from the Pascua Yaqui Tribe.

Major correspondence included the following letters to tribal officials and staff:

- July 2009: Initial formal consultation letter with project description and offer of meetings or a tour.
- February 2010: Class III survey report with preliminary NRHP eligibility determinations provided to tribes for review and comment.
- April 2010: Draft EIS provided to tribes with request for review and comment.
- April 2011: Following a hiatus in the project schedule, the BLM updated the tribes on the addition of the PV sub-alternative, eligibility determinations, and the likelihood of an adverse effect determination with potential mitigation measures of data recovery, avoidance, and monitoring. Tribal responses concurred with the eligibility and effect determinations.
- August 2011: Tribes were provided a copy of the draft MOA for review and comment. The Gila River Indian Community responded that its legal department was reviewing the document. The Hopi Tribe declined the invitation to be a formal concurring party to the MOA but requested the continued opportunity to review any treatment or data recovery plans.

BLM staff and managers presented information and responded to questions at four meetings of the Four Southern Tribes Cultural Resource Group, which consists of staff and representatives from the Salt River Pima-Maricopa Indian Community, the Gila River Indian Community, the Ak Chin Indian Community, and the Tohono O'odham Nation. These meetings took place in July 2009, March 2010, March 2011, and August 2011. The Phoenix District manager and Lower Sonoran Field Office manager attended meetings held in 2011. BLM managers also discussed the project proposal with a representative of the Tohono O'odham Nation at a public scoping meeting in August 2009.

Government-to-government consultation has not revealed any significant sources of controversy regarding cultural resources or tribal concerns with the proposed undertaking. The THPO of the Tohono O'odham Nation stated that it is inappropriate to site a solar energy project near two wilderness areas and a national monument. Tribes have not identified any significant traditional places or sacred sites within the proposed Project Area. In its comments on the draft EIS, the Tohono O'odham Nation noted that no "cultural landscape study" was completed but did not offer relevant information. In response, the BLM will require that any proposed data recovery plan developed as mitigation, even if focused on a single site, will incorporate a research design that places the site within the larger context of cultural landscape use. Tribes will be offered the opportunity to contribute to this aspect of the data recovery study. Continuing consultation will provide an open forum for tribes to remain involved and to voice any evolving concerns.

5.5 Recipients of this EIS

Pursuant to CEQ regulations (40 CFR § 1502.19), the BLM is circulating this final EIS to 1) agencies having jurisdiction by law or special expertise with respect to any environmental impact involved and any appropriate federal, state or local agency authorized to develop and enforce environmental standards; 2) the applicant; and 3) any agencies, organizations, or individuals requesting a copy of the document.

The SSEP EIS distribution list was developed from the stakeholders lists compiled prior to and during the scoping process and then supplemented throughout the planning process. Those interested in receiving project updates were able to indicate their interest on public meeting comment forms and project mailers, or submit their information to Joe Incardine via email, telephone, fax, or writing. A complete list of all recipients of the draft and final EISs can be found in the administrative record.

5.6 List of Preparers

The SSEP EIS was written by a team composed of BLM and third-party-contractor personnel. Under direction of the BLM, the consulting team prepared alternatives, collected data for the analysis, assessed potential effects of the alternatives, and prepared other chapters with additional comment and critique from the cooperating agencies. The BLM has approved the content of this EIS. Table 5.3 identifies the agencies and individuals involved with the preparation and review of this EIS.

Table 5.3 List of Preparers

Entity		Responsibility	Title	Years of Experience
BLM				
Andersen	Jim	Lands Use/Access	Lead Realty Specialist	32
Applegate	Don	Recreation	Recreation Program Leader	30
Bickauskas	Tom	Travel Management	Travel Management Coordinator	9
Depukat	Kathleen	Project Management	Phoenix District Project Manager	23
Gibson	William	Travel Management	Travel Management Coordinator	30
Grove	Kevin	Wildlife Resources	Wildlife Biologist	13
Harris, Ph.D.	William	Hazardous Materials	HAZMAT/AML Coordinator	30
Horyza	Chris	Environmental Justice, Social Economics, NEPA Compliance	NEPA Coordinator	31
Hughes	Tim	Wildlife Resources	Wildlife Biologist	24
Incardine	Joe	Project Management	National Project Manager	30
Johnson	Michael	Cultural Resources, Section 106 Consultation, Paleontology	Deputy Preservation Officer	26
Mahoney	Ken	Wilderness, National Monuments, Special Designations	National Landscape Conservation System Coordinator	32
Masters	Elroy	Vegetation Resources	Biologist	18
Mogel	Angela	Lands Use/Access	Lead Realty Specialist	28
Nicholls	Craig	Air Quality	National Air Quality Modeler	21
Ragsdale	Jack	Recreation, Visual Resources	Recreation Planner	30

Table 5.3 List of Preparers

Entity		Responsibility	Title	Years of Experience
Renthal	Jim	Air Quality, Climate, Water Resources, Drainage, Geology/Minerals/Soils	Natural Resources Specialist	33
Stone	Connie	Cultural Resources, Section 106 Consultation	Renewable Energy Coordination Office Archaeologist	34
Warren	Melissa	Lands and Realty	Realty Specialist	10
Logan Simpson				
Higgins	Patrick	Noise	NEPA Coordinator	41
SWCA				
Bellavia	Cara	Technical Resource Lead	Planning Specialist	13
Burch Vernon	Laura	Socioeconomics, Paleontology	Planning Specialist, AICP	9
Childs	Amanda	Geology/Minerals, Soils, Hazardous Materials	Planning Specialist	14
Christensen	Amanda	Wildlife	Planning Specialist	8
Christensen	John	Water/Drainage	Planning Specialist, P.G.	27
Connell	Jeff	Technical Resource Lead	Planning Specialist	31
Gaddis	Ben	Assistant Project Manager, NEPA Compliance	Planning Specialist	12
Gaddis	Erica	Air Quality, Water quality	Planning Specialist, Ph.D.	6
Hornbeck	Hope	Vegetation Resources	Planning Specialist	8
Hornung	Elisha	Public Involvement	Planning Specialist	10
Hultgren	Andy	Climate	Planning Specialist	8
Knox	Steve	Project Manager, NEPA Compliance	NEPA Specialist	35
Larson	Greg	Project Manager, EIS Writing Team Lead	Planning Specialist	7
Leslie	Steve	Noise, Visual Resources	Planning Specialist	13
Orcutt-Gachiri	Heidi	Technical Editing	Technical Editor	13
Rausch	Ryan	Transportation and Access	Planning Specialist	6
Reber	Deb	Land Use, Recreation, Special Designations, Livestock	Planning Specialist	22
Tremblay	Adrienne	Cultural Resources	Planning Specialist	5
Tucker-Burfitt	Linda	Technical Editing, Formatting, Publication	Lead Technical Editor	8
Smith	Debbi	Formatting, Publication	Formatting/Production Coordinator	8
EPG and Subconsultants				
Carr	David	Water (groundwater) Technical Report	Senior Consultant/Hydrogeologist	28
Duncan	Kevin	Transportation, Land Use, and Recreation Technical Report	Regional Manager and Senior Environmental Planner	8
Farmer	Bob	Air Quality Technical Report, Hazardous Materials Technical Report	Program Director, Air Quality Services	25
Kirby	Michael	Paleontology Technical Report,	Director of Earth Sciences	20

Table 5.3 List of Preparers

Entity		**Responsibility**	**Title**	**Years of Experience**
		Geology/Minerals/Soils Technical Report		
Mantey	Bob	Noise Technical Report	Principal Noise Consultant	30
McDonald	Lisa	Health and Safety, Socioeconomics Technical Report	Senior Economist	17
Moody	Jack	Drainage Technical Report (draft), Water (surface) Technical Report	Director of Water Resources	26
Schwartz	Marc	Visual Technical Report, Visual Simulations	Director of Visual Resources	10
Shelley	Steven	Cultural Resources Technical Report	Director of Cultural Resources	20
Smigielski	Andrew	Traffic	Principal and Senior Traffic Engineer	17
Smith	Linwood	Biological Assessment, Biology (wildlife and vegetation) Technical Report	Director of Biological Resource Services	36

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